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**THE NASA DIGITAL VGH PROGRAM -  
EXPLORATION OF METHODS AND FINAL RESULTS**

**Volume V - DC 10 Data 1981-1982: 129 HOURS**

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## **FOREWORD**

This report was prepared by Eagle Engineering, Inc., Hampton Division, under contract NASW 4430, sponsored by NASA Langley Research Center and the Federal Aviation Administration Technical Center under the FAA-NASA Interagency Agreement No. DTFA03-890-A-00019 of 13 June 1989. This report fulfills the requirement of the Program Plan for the National Aging Aircraft Research Program, DOT/FAA/CT-88/32, August 1989, Paragraph 2.3.2.1, Flight Loads.

The Eagle Engineering, Inc. effort was performed by Norman L. Crabill and administered under the direction of Joseph W. Stickle (NASA Langley Research Center) and Thomas DeFiore (FAA Technical Center).



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SUMMARY

Data obtained from the Digital Flight Data Recorder System of Douglas DC 10 aircraft in 23 flights and 129 hours of airline revenue operations are presented as an extension of the work documented in Volume I of this report. Data on conditions with flap deployment are given. No discussion of the data is presented.

INTRODUCTION

This document presents the results of the NASA DVGH Program obtained during 1981-1982 operations of Douglas DC 10 aircraft. The volume is an extension of work and methods documented in Volume I. The data reduction analysis and methods and data presentation are essentially the same as those reported in Volume I.

## AIRCRAFT AND INSTRUMENTATION

### Aircraft

The aircraft type was the Douglas DC 10-30 with three General Electric CF6-6D1 turbofan engines. Characteristics of the aircraft used in the data reduction process are given in Table I. The configuration is shown in figure 1.

### Instrumentation

The data were obtained from the Digital Flight Data Recorder System described in Volume I. Measurements were:

<u>Parameter</u>	<u>Range and Units</u>	<u>Samples per Second</u>
$a_n + 1$	-3g to +6g	4
$a_y$	-1g to +1g	4
CAS	100 to 450 kts	1
HP	-1,000 to 50,000 ft	1
FLP	-5° to 60°	1

### SCOPE OF DATA

Data were collected from several aircraft operating in regular airline service over the area shown in figure 2 during 1980 through 1982. All of the data (23 flights and 129 hours) were obtained during passenger-carrying revenue service. Due to operational difficulties, it was not practical to obtain continuous data from one aircraft as in Volumes I and II; it was therefore decided to obtain the data from any of several DC 10-30 aircraft being operated by the airline over the service route during the 11 months of the test.

## DATA REDUCTION PROCESS

The Data Reduction Process is basically the same as described in Volume I. The filter used to separate maneuver and gust acceleration was the same as that described in Volume I, with the low and high limits of the band pass set at 0.09 and 1.2 Hz, respectively, based on an inspection of representative spectra.

## RESULTS

Presentation of Flight Profile Statistics results is similar to that described in Volume I. Flight Profile Statistics are given in Percent of Time, and as Maximum Values on a Percent of Flight basis for Entire Flights (flaps up or down) and for Flaps Deflected. For operations reported in this volume, the conditions existing at flap retraction after lift off, and the conditions existing at flap deflection before landing are given.

Acceleration Derived Statistics are also presented as in Volume I, except that with Flaps Deflected, the maximum  $a_n$  per flight and the Equivalent Airspeed occurring are presented for the various flap detents in take off and landing.

The detailed Flight Profile and Acceleration Derived Statistics are given in figures 3 through 24, as shown in Table II. No discussion of the data is presented. The Acceleration Derived quantities in this volume are subject to the same limitations discussed in Volume I, which indicates that the exceedances derived from the DFDR system at 4 samples per second may be significantly less than if actual peak values were counted.

#### **CONCLUDING REMARKS**

Data obtained from the Digital Flight Data Recorder system of Douglas DC 10-30 in 23 flights and 129 hours of airline revenue operations are presented as an extension of the work documented in Volume I of this report. Some new data on conditions with flap deployment are given. No general discussion of the data is presented.

TABLE I  
DOUGLAS DC 10-30 CHARACTERISTICS USED IN THE ANALYSIS

○ Geometrical Characteristics

- Wing Area = 3647.5 ft<sup>2</sup>
- Wing Mean Chord = 24.65 ft

○ Lift Curve Slope  $C_{L\alpha}$  per degree

- Flaps up =  $f(M, HP)$

<u>M</u>	<u>HP = 0</u>	<u>20 kft</u>	<u>40 kft</u>
.2	.0885	.0890	.0890
.4	.0850	.0890	.0915
.5	.0825	.0890	.0925
.6	.0790	.0890	.0940
.7	.0755	.0900	.0980
.8	-	.0935	.1050
.90	-	.1005	.1160

- Flaps down =  $f(FLP)$

<u>FLP, deg</u>	<u>HP ≈ 0</u>
0	.0885
2	.0930
12	.0970
17	.0970
24	.0980
37	.0970
50	.0985

- Weight was computed linearly with time from take off to landing as described in Appendix C in Volume I.

**TABLE II**  
**INDEX OF FLIGHT PROFILE AND ACCELERATION STATISTICS**

**FLIGHT PROFILE STATISTICS**

o ENTIRE FLIGHTS

Figure Number	Subject	Page Numbers
3	Weight vs. Flight Duration	11-16
4	Altitudes and Gross Weights	17
5	Altitudes and Airspeeds	18-21
6	Altitude Summary	22
7	Maximum Altitudes	23-24

o FLAPS DEFLECTED

8	Flap Detent Use	25
9	Weights, Altitudes and Airspeeds	26-36
10	Flap Deflection Times	37-39
11	Equivalent Airspeeds and Detents	40
12	Flap Use above 10,000 ft	41

TABLE II (Continued)  
ACCELERATION DERIVED STATISTICS

o ENTIRE FLIGHTS

Figure Number	Subject	Page Numbers
13	Normal Acceleration Exceedances	
(a)	$a_n$ matrix	42
(b)	$a_{nM}$ matrix	43
(c)	$a_{nG}$ matrix	44
(d) - (m)	$a_n$ , $a_{nM}$ , $a_{nG}$ plots	45-54
14	Lateral Acceleration Exceedances	
(a)	$a_y$ matrix	55
(b) - (k)	$a_y$ plots	56-65
15	$U_{de}$ Exceedances	
(a)	$U_{de}$ matrix	66
(b) - (k)	$U_{de}$ plots	67-76
16	Peak Positive and Negative $a_n$ vs. Altitude	
(a)	$a_n$ matrix	77
(b) - (k)	$a_n$ plots	78-87
17	Peak Positive and Negative $a_{nM}$ vs. Altitude	
(a)	$a_{nM}$ matrix	88
(b) - (k)	$a_{nM}$ plots	89-98
18	Peak Positive and Negative $a_{nG}$ vs. Altitude	
(a)	$a_{nG}$ matrix	99
(b) - (k)	$a_{nG}$ plots	100-109

TABLE II (Concluded)

19 Peak Positive and Negative  $U_{de}$  vs. Altitude

(a)	$U_{de}$ matrix	110
(b)-(k)	$U_{de}$ plots	111-120

o FLAPS DEFLECTED

Figure Number	Subject	Page Numbers
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20  $a_n$  Exceedances with Flaps Deflected

(a)	Take Off Detents matrix	121
(b)	Take Off Detents plot	122
(c)	Landing Detents matrix	123
(d)	Landing Detents plot	124

21 Peak Positive and Negative  $a_n$  per flight and EAS bands

(a)-(d)	Take Off Detents	125-128
(e)-(j)	Landing Detents	129-135

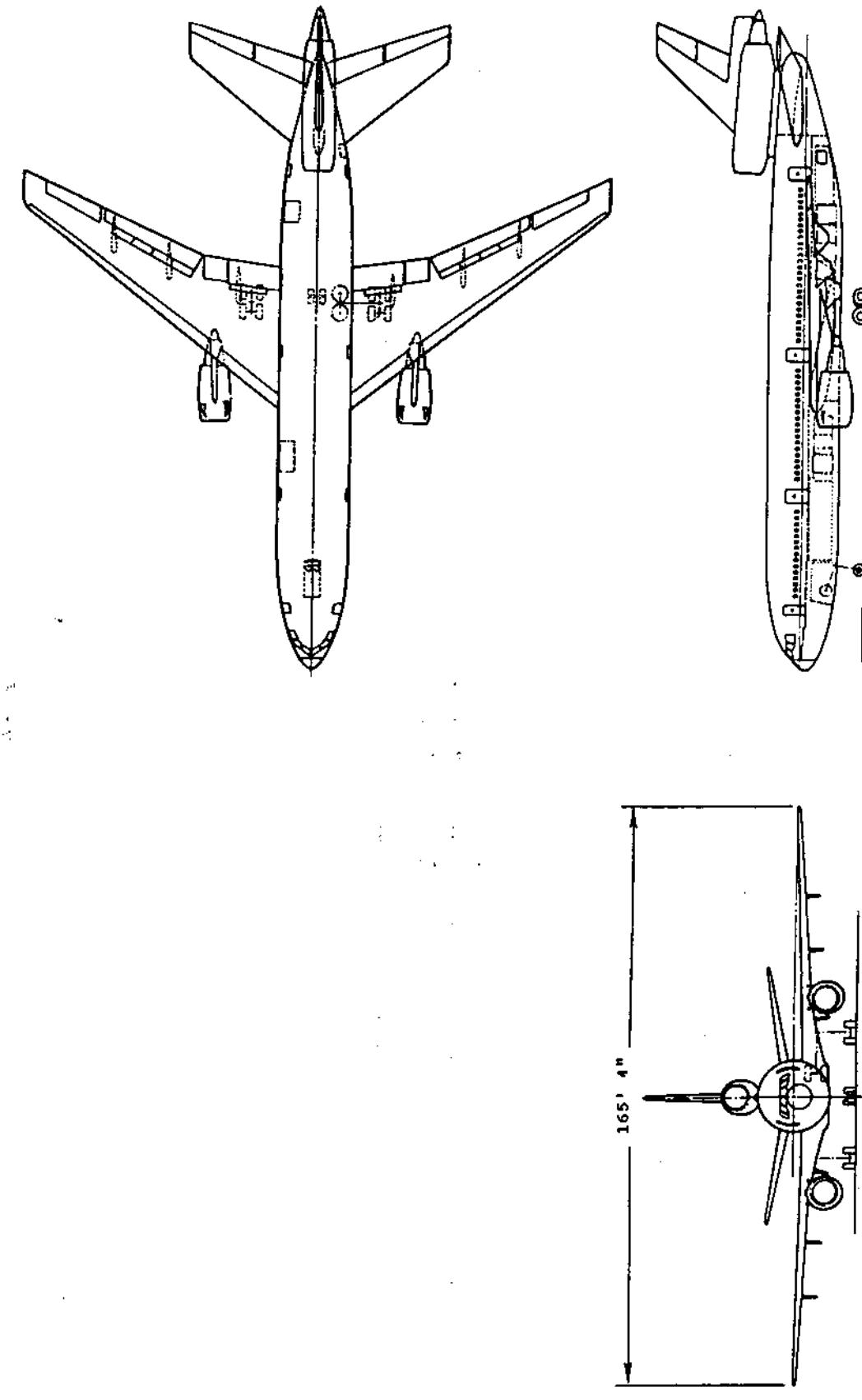
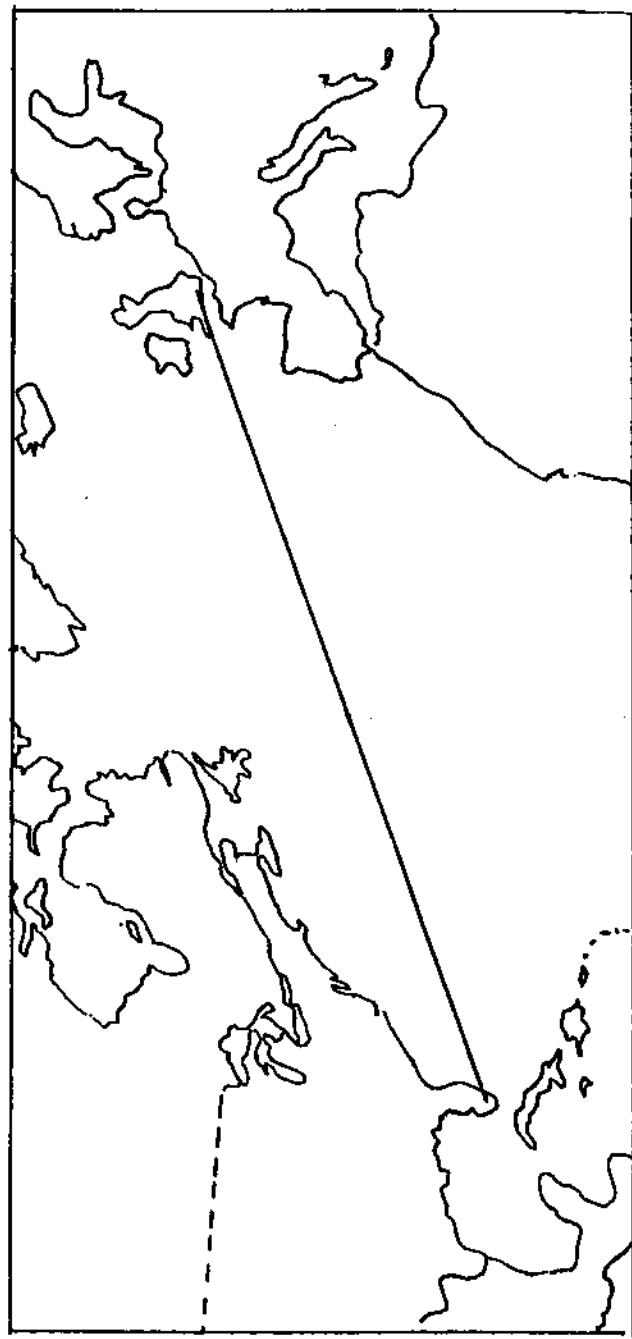


FIGURE 1.- Three view drawing of the aircraft.



April 1981 - March 1982

23 Flights

129 Hours

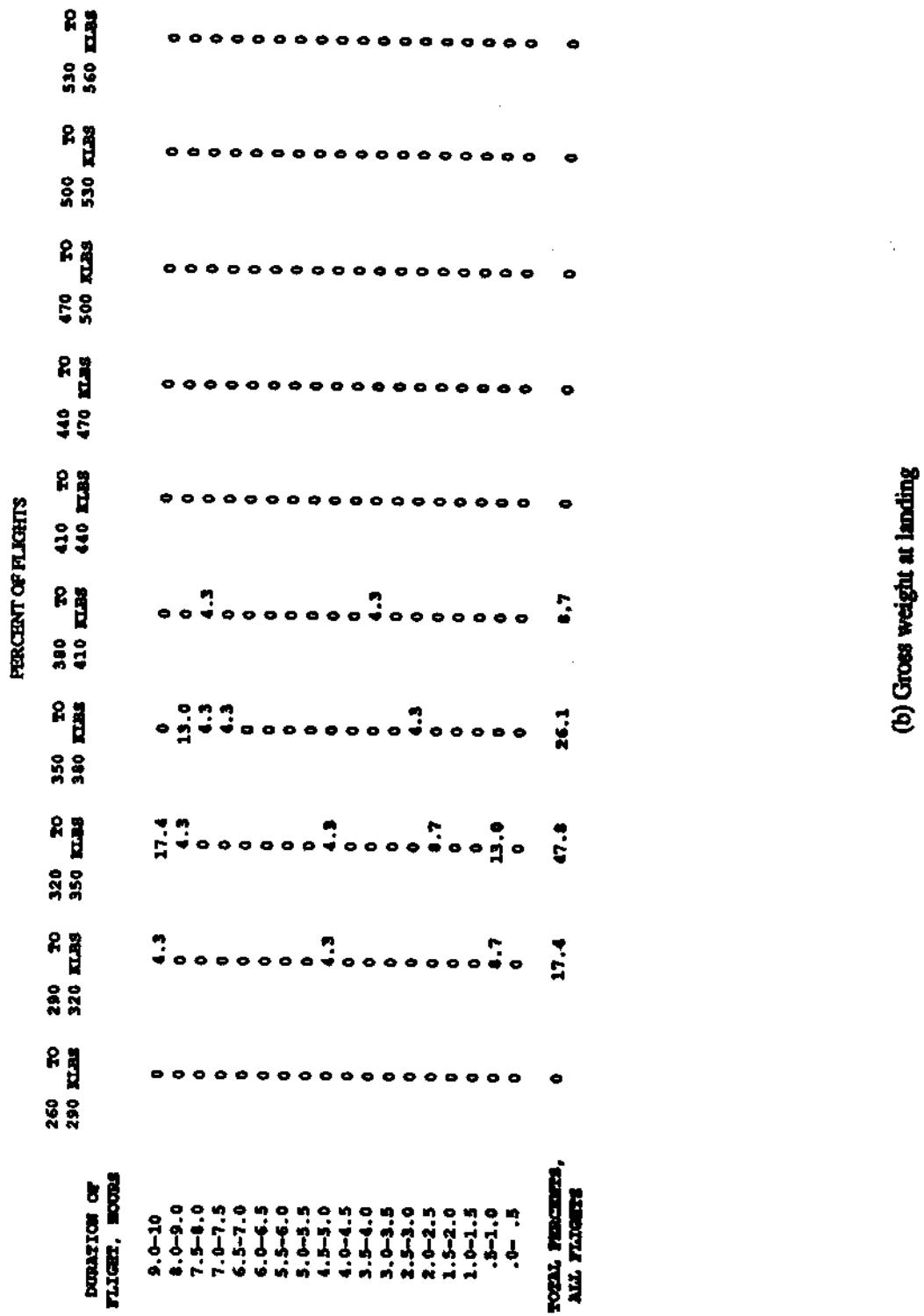
59905 N. Miles

Figure 2. - Location of service area and scope of data.

DURATION OF FLIGHT, HOURS	PERCENT OF FLIGHTS									
	260 KILO	270 KILO	280 KILO	290 KILO	300 KILO	310 KILO	320 KILO	330 KILO	340 KILO	350 KILO
9.0-10	0	0	0	0	0	0	0	0	0	4.3
8.0-9.0	0	0	0	0	0	0	0	0	0	0
7.5-8.0	0	0	0	0	0	0	0	0	0	0
7.0-7.5	0	0	0	0	0	0	0	0	0	0
6.5-7.0	0	0	0	0	0	0	0	0	0	0
6.0-6.5	0	0	0	0	0	0	0	0	0	0
5.5-6.0	0	0	0	0	0	0	0	0	0	0
5.0-5.5	0	0	0	0	0	0	0	0	0	0
4.5-5.0	0	0	0	0	0	0	0	0	0	0
4.0-4.5	0	0	0	0	0	0	0	0	0	0
3.5-4.0	0	0	0	0	0	0	0	0	0	0
3.0-3.5	0	0	0	0	0	0	0	0	0	0
2.5-3.0	0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0	0
1.5-2.0	0	0	0	0	0	0	0	0	0	0
1.0-1.5	0	0	0	0	0	0	0	0	0	0
.5-1.0	0	0	0	0	0	0	0	0	0	0
.0-.5	0	0	0	0	0	0	0	0	0	0
TOTAL PERCENTS, ALL FLIGHTS	0	0	17.4	8.7	13.0	4.3	0.7	4.3	30.4	19.0

(a) Gross weight at take off

Figure 3.- Percent of flights; weights vs durations.



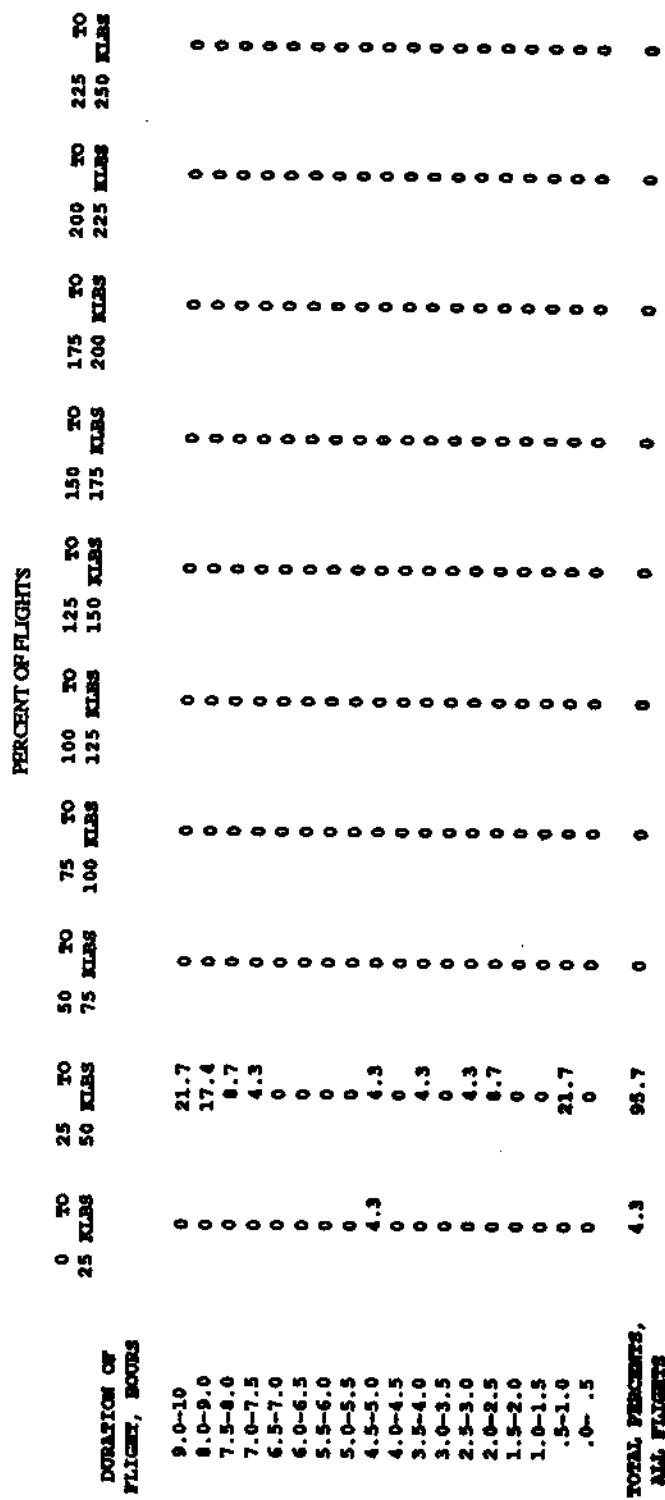
(b) Gross weight at landing

Figure 3.- Continued.

DURATION OF FLIGHT, HOURS	PERCENT OF FLIGHTS								
	0 TO 25 KILOMETERS	25 TO 50 KILOMETERS	50 TO 75 KILOMETERS	75 TO 100 KILOMETERS	100 TO 125 KILOMETERS	125 TO 150 KILOMETERS	150 TO 175 KILOMETERS	175 TO 200 KILOMETERS	200 TO 225 KILOMETERS
0-0.5	0	0	0	0	0	0	0	0	0
.5-1.0	0	0	0	0	0	0	0	0	0
1.0-1.5	0	0	0	0	0	0	0	0	0
1.5-2.0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0
2.5-3.0	0	0	0	0	0	0	0	0	0
3.0-3.5	0	0	0	0	0	0	0	0	0
3.5-4.0	0	0	0	0	0	0	0	0	0
4.0-4.5	0	0	0	0	0	0	0	0	0
4.5-5.0	0	0	0	0	0	0	0	0	0
5.0-5.5	0	0	0	0	0	0	0	0	0
5.5-6.0	0	0	0	0	0	0	0	0	0
6.0-6.5	0	0	0	0	0	0	0	0	0
6.5-7.0	0	0	0	0	0	0	0	0	0
7.0-7.5	0	0	0	0	0	0	0	0	0
7.5-8.0	0	0	0	0	0	0	0	0	0
8.0-8.5	0	0	0	0	0	0	0	0	0
8.5-9.0	0	0	0	0	0	0	0	0	0
9.0-10	0	0	0	0	0	0	0	0	0
TOTAL PERCENTS, ALL FLIGHTS	0	21.7	8.7	4.3	13.0	0	0	30.4	21.7

(c) Fuel weight at take off

Figure 3.-Continued.



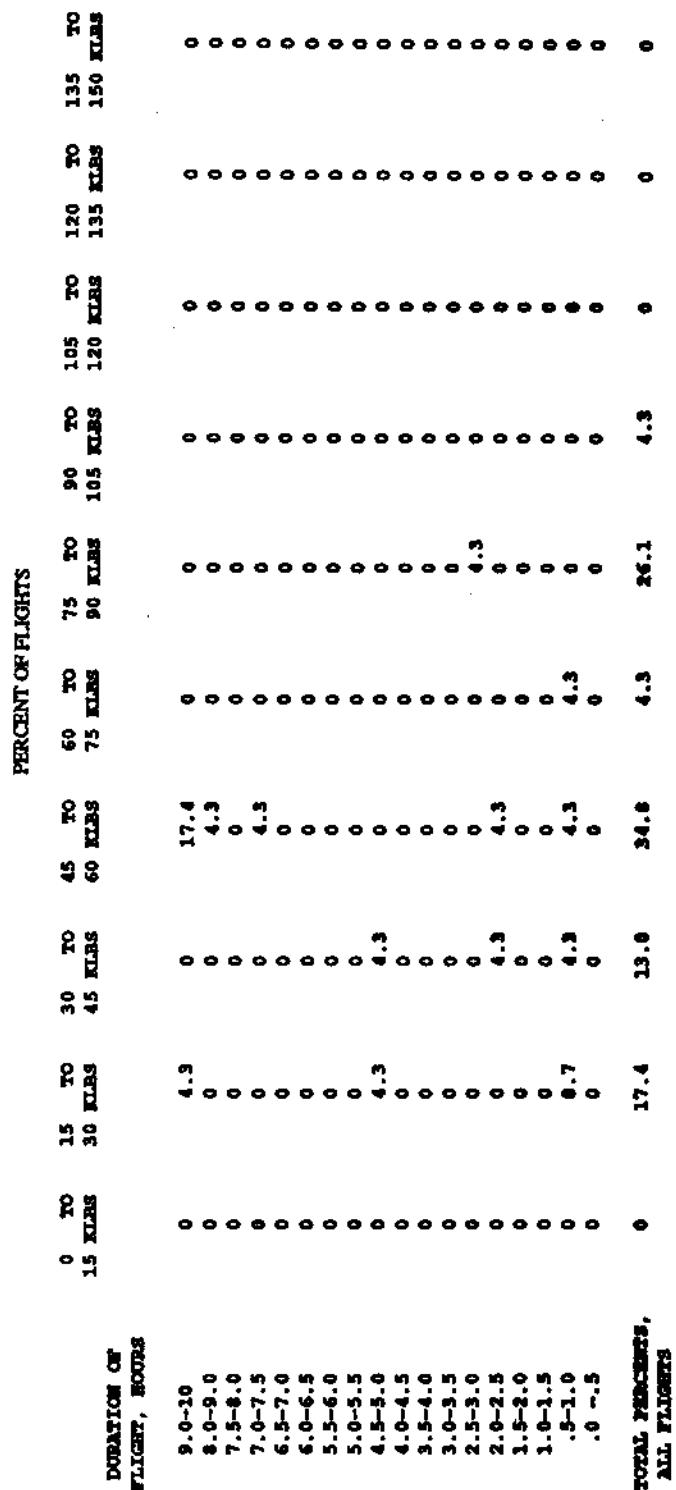
(d) Fuel weight at landing

Figure 3.-Continued.

DURATION OF FLIGHT, HOURS	PERCENT OF FLIGHTS									
	0 TO 25 KILO	25 TO 50 KILO	50 TO 75 KILO	75 TO 100 KILO	100 TO 125 KILO	125 TO 150 KILO	150 TO 175 KILO	175 TO 200 KILO	200 TO 225 KILO	225 TO 250 KILO
9.0-10	0	0	0	0	0	0	0	0	0	0
8.0-9.0	0	0	0	0	0	0	0	0	0	0
7.5-8.0	0	0	0	0	0	0	0	0	0	0
7.0-7.5	0	0	0	0	0	0	0	0	0	0
6.5-7.0	0	0	0	0	0	0	0	0	0	0
6.0-6.5	0	0	0	0	0	0	0	0	0	0
5.5-6.0	0	0	0	0	0	0	0	0	0	0
5.0-5.5	0	0	0	0	0	0	0	0	0	0
4.5-5.0	0	0	0	0	0	0	0	0	0	0
4.0-4.5	0	0	0	0	0	0	0	0	0	0
3.5-4.0	0	0	0	0	0	0	0	0	0	0
3.0-3.5	0	0	0	0	0	0	0	0	0	0
2.5-3.0	0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0	0
1.5-2.0	0	0	0	0	0	0	0	0	0	0
1.0-1.5	0	0	0	0	0	0	0	0	0	0
.5-1.0	21.7	0	0	0	0	0	0	0	0	0
.0 -.5	0	0	0	0	0	0	0	0	0	0
TOTAL PERCENTS, ALL FLIGHTS	21.7	8.7	8.7	0	4.3	30.4	17.4	0	0	0

(e) Fuel burn vs flight duration

Figure 3.-Continued.



(f) Payload weight vs flight duration

Figure 3.- Concluded.

		PRESSURE ALTITUDE BANDS									
		500 TO 550 FT	550 TO 600 FT	600 TO 650 FT	650 TO 700 FT	700 TO 750 FT	750 TO 800 FT	800 TO 850 FT	850 TO 900 FT	900 TO 950 FT	950 TO 1000 FT
GROSS WEIGHT KGS	-500 TO 550 FT	4500 TO 5500 FT	5500 TO 6500 FT	6500 TO 7500 FT	7500 TO 8500 FT	8500 TO 9500 FT	9500 TO 10500 FT	10500 TO 11500 FT	11500 TO 12500 FT	12500 TO 13500 FT	13500 TO 14500 FT
AVERAGE WEIGHT KGS	4500	5500	6500	7500	8500	9500	10500	11500	12500	13500	14500
<b>PERCENT TOTAL TIME =</b>											
250-290	0	0	0	0	0	0	0	0	0	0	0
290-320	0	0	0	0	0	0	0	0	0	0	0.0408
320-350	0.0455	0.0663	0.0817	0.1297	0.1612	0.2075	0.2453	0.2850	0.3250	0.3650	0.4057
350-380	0.0663	0.0774	0.1002	0.1461	0.1861	0.2338	0.2856	0.3360	0.3860	0.4360	0.4860
380-410	0.0803	0.0983	0.0743	0.0826	0.0862	0.0936	0.0939	0.1045	0.1045	0.1045	0.1045
410-440	0.0199	0.0187	0.0289	0.0237	0.0336	0.0327	0.0327	0.0299	0.0299	0.0299	0.0299
440-470	0.0446	0.0651	0.0771	0.0696	0.0674	0.0644	0.0644	0.0658	0.0658	0.0658	0.0644
470-500	0.0400	0.0211	0.0305	0.0763	0.0857	0.1506	0.2776	0.0667	0.0667	0.0667	0.0667
500-530	0.2903	0.2299	0.2915	0.2428	0.3254	0.3421	0.2884	0.2884	0.2884	0.2884	0.2884
530-560	0.1068	0.1243	0.1192	0.1351	0.1377	0.1795	0.0586	0.0586	0.0586	0.0586	0.0586
<b>PERCENT TOTAL TIME =</b>											
AVE GROSS WEIGHT IN ALTITUDE BAND	0.6933	0.6933	0.6425	0.8214	0.8944	0.9671	0.9489	0.5307	0	0	0.3987
AVERAGE WEIGHT KGS	451.05	451.05	455.97	453.32	455.38	480.31	484.00	466.14	398.46	0	0
<b>PERCENT TOTAL TIME =</b>											
250-290	0	0	0	0	0	0	0	0	0	0	0
290-320	0.0271	0	0.0402	0.0336	0.1341	0	0	0	0	0	1.2101
320-350	0.0336	0.0763	0.3228	0.1176	0.3804	0.0427	0.2743	0	0	0	0.0727
350-380	0.0621	0.1732	0.0394	0	0.6963	0.1125	0.1876	0.1288	0	0	0.7628
380-410	0	0.0646	0	0	0	0	0	0.6452	0.6452	0	0.6028
410-440	0	0	0	0	0	0	0.2365	0.0564	0.0564	0	0.1473
440-470	0	0	0	0	0	0	0.0536	0.2382	0.2382	0	0.2273
470-500	0	0	0	0	0	0	0.0732	0.1432	0.1432	0	0.3944
500-530	0	0	0	0	0	0	0.0649	0.2842	0.2842	0	0.7860
530-560	0	0	0	0	0	0	0.4972	0.2250	0.2250	0	0.7122
<b>PERCENT TOTAL TIME =</b>											
AVE GROSS WEIGHT IN ALTITUDE BAND	0.1226	0.3910	0.2224	0.1913	0.5787	0.8485	0.6019	0.2941	0	0	0.1447
AVERAGE WEIGHT KGS	343.53	371.86	326.80	323.33	332.06	408.24	459.20	393.67	0	0	0
<b>PERCENT TOTAL TIME =</b>											
250-290	0	0	0	0	0	0	0	0	0	0	0
290-320	0.2176	0.1127	0.1230	0.1196	0.0584	0.6453	0.6547	0.0625	0	0	0.7878
320-350	0.6314	0.3920	0.3600	0.2892	0.2259	0.2054	0.2054	0.1426	0	0	2.5572
350-380	0.3827	0.3604	0.2803	0.2362	0.2501	0.2501	0.2501	0.3685	0	0	2.4269
380-410	0.1354	0.1045	0.0537	0.0356	0.0409	0.0409	0.0409	0.0621	0.2274	0	0.7744
410-440	0	0	0	0	0	0	0	0	0	0	0
440-470	0	0	0	0	0	0	0	0	0	0	0
470-500	0	0	0	0	0	0	0	0	0	0	0
500-530	0	0	0	0	0	0	0	0	0	0	0
530-560	0	0	0	0	0	0	0	0	0	0	0
<b>PERCENT TOTAL TIME =</b>											
AVE GROSS WEIGHT IN ALTITUDE BAND	1.3672	0.9537	0.8289	0.6804	0.5763	0.5925	0.6125	0.6452	0	0	0.4566
AVERAGE WEIGHT KGS	344.57	349.00	345.44	345.27	349.19	351.80	352.73	345.36	0	0	0
<b>TOTAL TIME, SECONDS</b>											
<b>TOTAL TIME %</b>											
<b>TOTAL ALTITUDE, FEET</b>											
<b>TOTAL ALTITUDE %</b>											

Figure 4.- Percent time in altitude and gross weight bands.

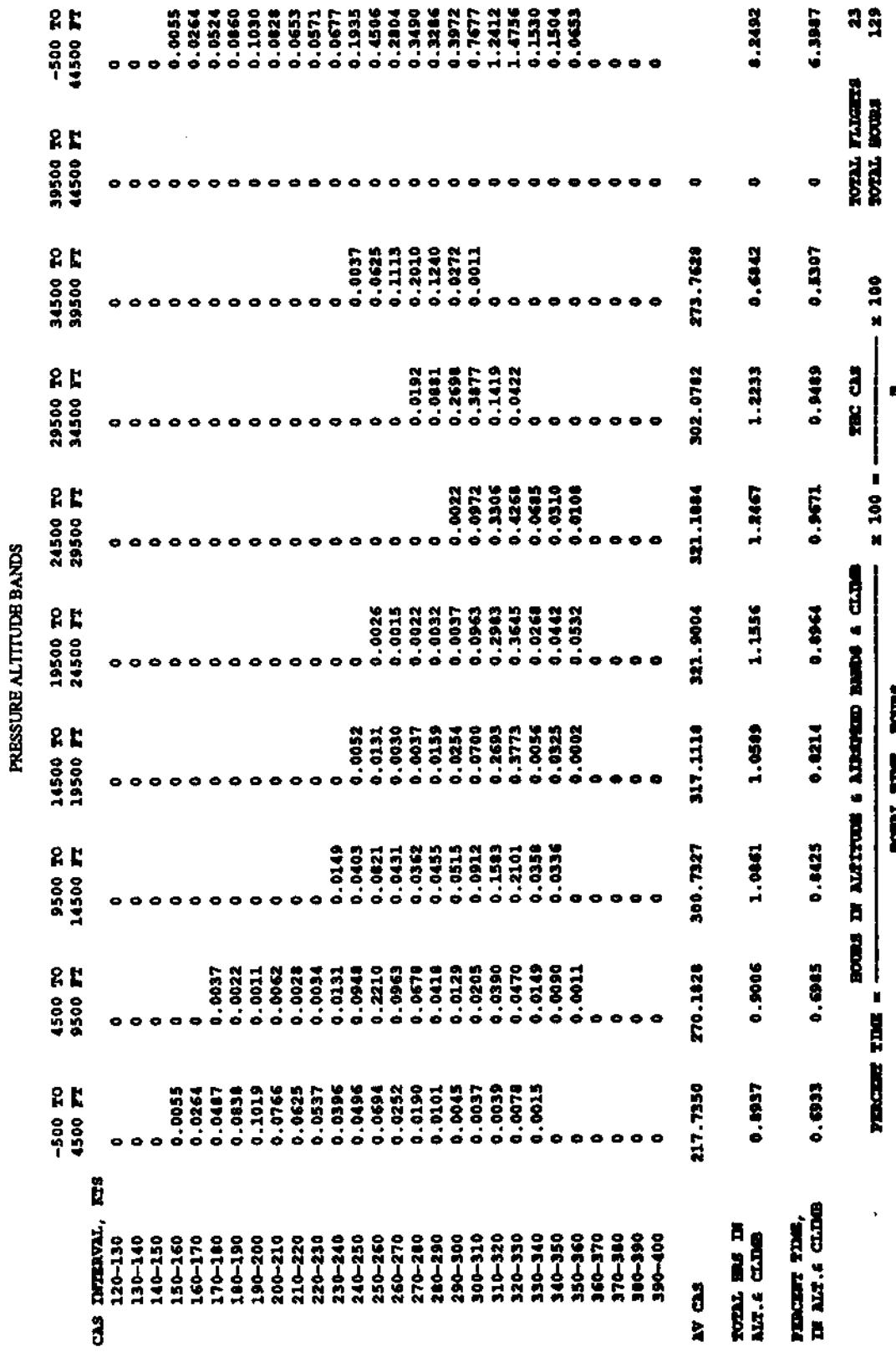


Figure 5.- Percent time in altitude and airspeed bands.

CAS INTERVAL, KCS	PRESSURE ALTITUDE BANDS						TOTAL TIME, HOURS	PERCENT TIME IN ALT & CLIMB	TOTAL HRS IN ALT & CLIMB
	-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT			
120-130	0	0	0	0	0	0	0	0	0
130-140	0	0	0	0	0	0	0	0	0
140-150	0.0022	0	0	0	0	0	0	0.0022	0.0022
150-160	0.0218	0	0	0	0	0	0	0.0218	0.0218
160-170	0.0132	0	0	0	0	0	0	0.0132	0.0132
170-180	0.0136	0	0	0	0	0	0	0.0136	0.0136
180-190	0.0196	0	0	0	0	0	0	0.0196	0.0196
190-200	0.0059	0.0060	0	0	0	0	0	0.0119	0.0119
200-210	0.0043	0.0261	0	0	0	0	0	0.0304	0.0304
210-220	0.0138	0.0457	0	0	0	0	0	0.0595	0.0595
220-230	0.0265	0.0065	0	0	0	0	0	0.0330	0.0330
230-240	0.0021	0.0071	0	0	0	0	0	0.0092	0.0092
240-250	0.0019	0.1228	0.0211	0	0	0	0	0.0028	0.0028
250-260	0	0.0887	0.0229	0	0	0	0	0.1486	0.1486
260-270	0	0.0162	0.0164	0	0	0	0	6.0636	6.0636
270-280	0	0.0012	0.0170	0	0.0076	0	0	15.4770	15.4770
280-290	0	0.0022	0.0159	0	0.0024	0	0	10.3749	10.3749
290-300	0	0.0022	0.0147	0.0136	0.0145	0.1599	0.1599	11.8459	11.8459
300-310	0	0.0022	0.0137	0.0137	0.0030	0.0631	0.0631	21.1924	21.1924
310-320	0	0.0021	0.0105	0.0092	0.0107	1.0624	1.0624	7.3657	7.3657
320-330	0	0	0.0254	0.0060	0.0220	4.4795	4.4795	1.2756	1.2756
330-340	0	0	0.0099	0.0340	0.0175	0.0828	0.0828	4.5542	4.5542
340-350	0	0	0.0135	0.0599	0.0866	0	0	0.2879	0.2879
350-360	0	0	0.0148	0.0039	0.1316	0	0	0.1603	0.1603
360-370	0	0	0.0219	0.0004	0.1151	0	0	0.1500	0.1500
370-380	0	0	0.0059	0	0.0215	0	0	0.1374	0.1374
380-390	0	0	0	0	0	0	0	0.0265	0.0265
390-400	0	0	0	0	0	0	0	0	0
AV CAS	190.8421	241.8620	304.0673	329.1382	345.7176	322.2825	296.3665	272.8247	0
TOTAL HRS IN ALT & CLIMB	0.1583	0.4267	0.2167	0.1950	0.7383	7.5999	39.4519	63.5498	0
PERCENT TIME IN ALT & CLIMB	0.1228	0.3310	0.2224	0.1513	0.5727	5.8485	30.6019	49.2941	0
TOTAL TIME, HOURS	x 100 =	x 100 =	x 100 =	x 100 =	x 100 =	TEC CAS	23	TOTAL FLIGHTS	23
PERCENT TIME =								TOTAL HOURS	129

(b) Level

Figure 5.-Continued.

CAS INTERVAL, KTS	PRESSURE ALTITUDE BANDS						TOTAL TIME, HOURS
	-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	
120-130	0	0	0	0	0	0	0
130-140	0.0444	0	0	0	0	0	0
140-150	0.2867	0	0	0	0	0	0.0444
150-160	0.2071	0	0	0	0	0	0.2867
160-170	0.1674	0	0	0	0	0	0.2071
170-180	0.1045	0.0082	0	0	0	0	0.1674
180-190	0.1088	0.0209	0	0	0	0	0.1127
190-200	0.0547	0.0278	0	0	0	0	0.1297
200-210	0.0873	0.1091	0	0	0	0	0.0825
210-220	0.0793	0.0614	0.0073	0	0	0	0.1954
220-230	0.0560	0.0265	0.0103	0	0	0	0.1480
230-240	0.0250	0.0780	0.0211	0	0	0	0.0933
240-250	0.0720	0.2698	0.0518	0	0	0	0.1272
250-260	0.0655	0.2310	0.0507	0	0	0	0.3935
260-270	0.0062	0.0160	0.0274	0	0	0	0.3779
270-280	0	0.0136	0.0427	0.0151	0.0247	0.0131	0.6396
280-290	0	0.0099	0.0801	0.0792	0.0340	0.0250	0.2943
290-300	0	0.0099	0.0440	0.0761	0.0646	0.0164	0.3443
300-310	0	0.0095	0.0569	0.0383	0.0169	0.0560	0.4024
310-320	0	0.0102	0.0849	0.0371	0.0508	0.0830	0.3233
320-330	0	0.0241	0.0763	0.0746	0.1001	0.1816	0.3740
330-340	0	0.0080	0.0524	0.0390	0.0661	0.1120	0.4552
340-350	0	0.0099	0.0936	0.1319	0.0713	0.0855	0.2307
350-360	0	0	0.0694	0.0545	0.0750	0.0129	0.3631
360-370	0	0	0.0528	0.1265	0.0575	0.0069	0.2118
370-380	0	0	0.0187	0.0172	0.0153	0	0.2537
380-390	0	0	0.0011	0	0	0	0.0513
390-400	0	0	0	0	0	0	0.0011
AV CAS	180.0199	242.5367	309.1649	330.2961	328.5059	323.9618	268.9171
TOTAL HRS IN ALT & CRZNS	1.7624	1.2294	1.0686	0.8772	0.7430	0.7639	0.7897
PERCENT TIME, IN ALT & CRZNS	1.3671	0.9537	0.8289	0.6804	0.5763	0.5925	0.6125
PERCENT TIME =							
METERS IN ALTITUDE & ADJUSTED BANDS A DESCENT							
TOTAL TIME, HOURS							
X 100 =							
TOTAL FLIGHTS							
X 100 =							
TOTAL HOURS							

(c) Descent

Figure 5.-Continued.

CAS INTERVAL, KTS	PRESSURE ALTITUDE BANDS						TOTAL FLIGHTS 23	TOTAL HOURS 129
	-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT		
120-130	0	0	0	0	0	0	0	0
130-140	0.0444	0	0	0	0	0	0	0.0444
140-150	0.2909	0	0	0	0	0	0	0.2909
150-160	0.2344	0	0	0	0	0	0	0.2344
160-170	0.2070	0	0	0	0	0	0	0.2070
170-180	0.1648	0.0119	0	0	0	0	0	0.1767
180-190	0.2122	0.0231	0	0	0	0	0	0.2353
190-200	0.1625	0.0349	0	0	0	0	0	0.1974
200-210	0.1682	0.1405	0	0	0	0	0	0.3087
210-220	0.1556	0.1099	0.0073	0	0	0	0	0.2728
220-230	0.1362	0.0364	0.0018	0	0	0	0	0.1634
230-240	0.0668	0.0983	0.0390	0	0	0	0	0.2640
240-250	0.1235	0.4874	0.1131	0.0052	0	0	0	0.7356
250-260	0.1349	0.5356	0.1558	0.0131	0.0026	0	0.0053	7.1100
260-270	0.0315	0.1485	0.0668	0.0030	0.0015	0	0.1112	6.1568
270-280	0.0190	0.0896	0.0959	0.0187	0.0345	0	0.4477	16.8754
280-290	0.0101	0.0539	0.1215	0.0862	0.0396	0.0131	0.1963	11.1944
290-300	0.0045	0.0250	0.1101	0.1152	0.0827	0.0250	0.16545	19.5588
300-310	0.0037	0.0321	0.1559	0.1385	0.1161	0.1784	0.0541	21.9920
310-320	0.0039	0.0513	0.2537	0.3096	0.3598	0.2183	7.7910	0.4567
320-330	0.0078	0.0711	0.3118	0.4579	0.4865	0.4406	0	2.8949
330-340	0.0015	0.0226	0.0980	0.0786	0.0869	0.0931	0	6.5150
340-350	0	0.0099	0.1407	0.2243	0.2023	0.2633	0	0.7216
350-360	0	0.0011	0.0638	0.0586	0.0586	0.1166	0	0.6938
360-370	0	0	0.0847	0.1269	0.1726	0.0237	0	0.4271
370-380	0	0	0.0237	0.0172	0.0368	0	0	0.3911
380-390	0	0	0.0011	0	0	0	0	0.0770
390-400	0	0	0	0	0	0	0	0.0011
Avg CAS	192.6052	252.1621	304.8151	323.6392	330.4103	322.2756	296.5994	272.8666
TOTAL HRS IN ALTITUDE BAND	2.0145	2.5567	2.4414	2.1311	2.6369	9.5506	41.4649	65.3236
PERCENT TIME, IN ALT AND DESCENT	2.1832	1.9931	1.8937	1.6531	2.0454	7.4091	32.1534	50.6700
PERCENT TIME =	X 100	X 100	X 100	X 100	X 100	X 100	X 100	X 100
HOURLY ALTITUDE & ALTITUDE BANDS								
TOTAL TIME, HOURS								

(d) All flight modes

Figure 5.-Concluded.

## PRESSURE ALTITUDE BANDS

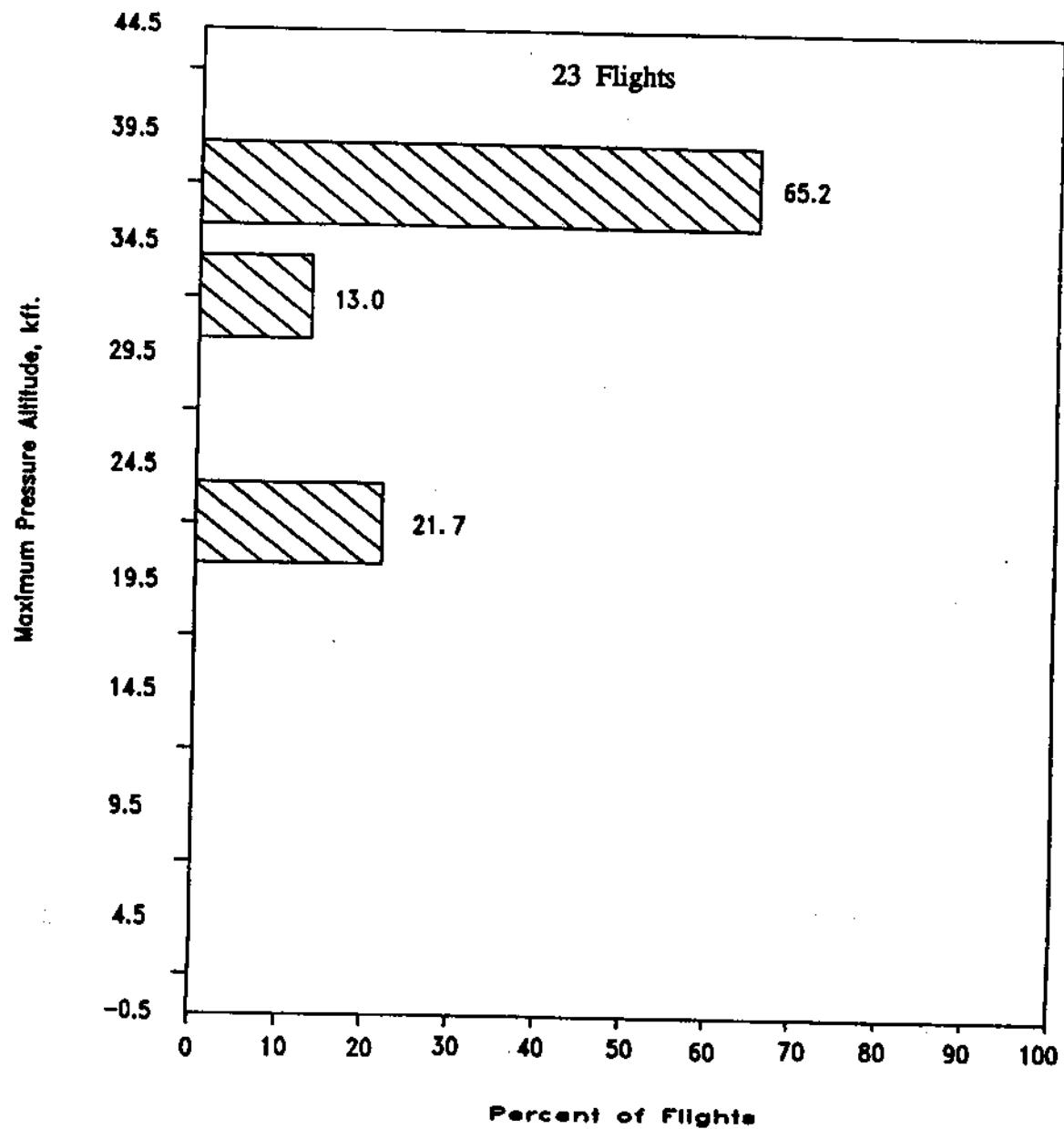
TIME INTERVAL, HRS IN ALTITUDE BAND	PRESSURE ALTITUDE BANDS									
	-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT	44500 TO
9.00-10.00	0	0	0	0	0	0	0	0	0	0
8.00- 9.00	0	0	0	0	0	0	0	0	0	0
7.50- 8.00	0	0	0	0	0	0	0	0	0	0
7.00- 7.50	0	0	0	0	0	0	0	0	0	0
6.50- 7.00	0	0	0	0	0	0	0	0	0	0
6.00- 6.50	0	0	0	0	0	0	0	0	0	0
5.50- 6.00	0	0	0	0	0	0	0	0	0	0
5.00- 5.50	0	0	0	0	0	0	0	0	0	0
4.50- 5.00	0	0	0	0	0	0	0	0	0	0
4.00- 4.50	0	0	0	0	0	0	0	0	0	0
3.50- 4.00	0	0	0	0	0	0	0	0	0	0
3.00- 3.50	0	0	0	0	0	0	0	0	0	0
2.50- 3.00	0	0	0	0	0	0	0	0	0	0
2.00- 2.50	0	0	0	0	0	0	0	0	0	0
1.50- 2.00	0	0	0	0	0	0	0	0	0	0
1.00- 1.50	0	0	0	0	0	0	0	0	0	0
.80- 1.00	0	0	0	0	0	0	0	0	0	0
.70- .80	0	0	0	0	0	0	0	0	0	0
.60- .70	0	0	0	0	0	0	0	0	0	0
.50- .60	0	0	0	0	0	0	0	0	0	0
.40- .50	0	0	0	0	0	0	0	0	0	0
.30- .40	0	0	0	0	0	0	0	0	0	0
.20- .30	0	0	4.348	0	0	4.348	0	0	0	0
.15- .20	21.739	9.696	4.348	4.348	13.043	9.696	4.348	0	0	0
.10- .15	60.870	34.783	52.174	26.087	47.826	26.087	8.696	4.348	0	0
.05- .10	17.391	52.174	43.478	69.565	34.783	21.739	21.739	0	0	0
.00- .05	0	0	0	0	0	0	0	0	0	0
<b>TOTAL FLIGHTS</b>	<b>2.3145</b>	<b>2.5567</b>	<b>2.4414</b>	<b>2.1311</b>	<b>2.6369</b>	<b>2.5506</b>	<b>41.4649</b>	<b>65.3236</b>	<b>0</b>	
<b>TOTAL PERCENT</b>										
<b>TIME IN ALL BAND</b>	<b>2.1832</b>	<b>1.9931</b>	<b>1.8937</b>	<b>1.6531</b>	<b>2.0454</b>	<b>7.4001</b>	<b>32.1634</b>	<b>50.6700</b>	<b>0</b>	

Figure 6.- Percent of flights vs time in altitude bands.

		TO MAXIMUM PRESSURE ALTITUDE BAND IN EACH FLIGHT VS DURATION										PERCENT OF FLIGHTS	
		-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT			
DURATION OF FLIGHT, SECONDS	-500 TO 4500 FT	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0
9.0-10.0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.0-9.0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5-8.0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.0-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0
6.5-7.0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.0-6.5	0	0	0	0	0	0	0	0	0	0	0	0	0
5.5-6.0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.0-5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5-5.0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.0-4.5	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-4.0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.0-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5-3.0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5-2.0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.0-1.5	0	0	0	0	0	0	0	0	0	0	0	0	0
.5-1.0	0	0	0	0	0	0	0	0	0	0	0	0	0
.0-.5	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL PERCENTS, ALL FLIGHTS	0	0	21.7	0	0	13.0	0	65.2	0	0	0	0	0

(a) Maximum altitude vs flight duration matrix

Figure 7.- Percent of flights to maximum altitude.



(b) Percent of flights to maximum pressure altitude per flight : Plot.

Figure 7.- Concluded.

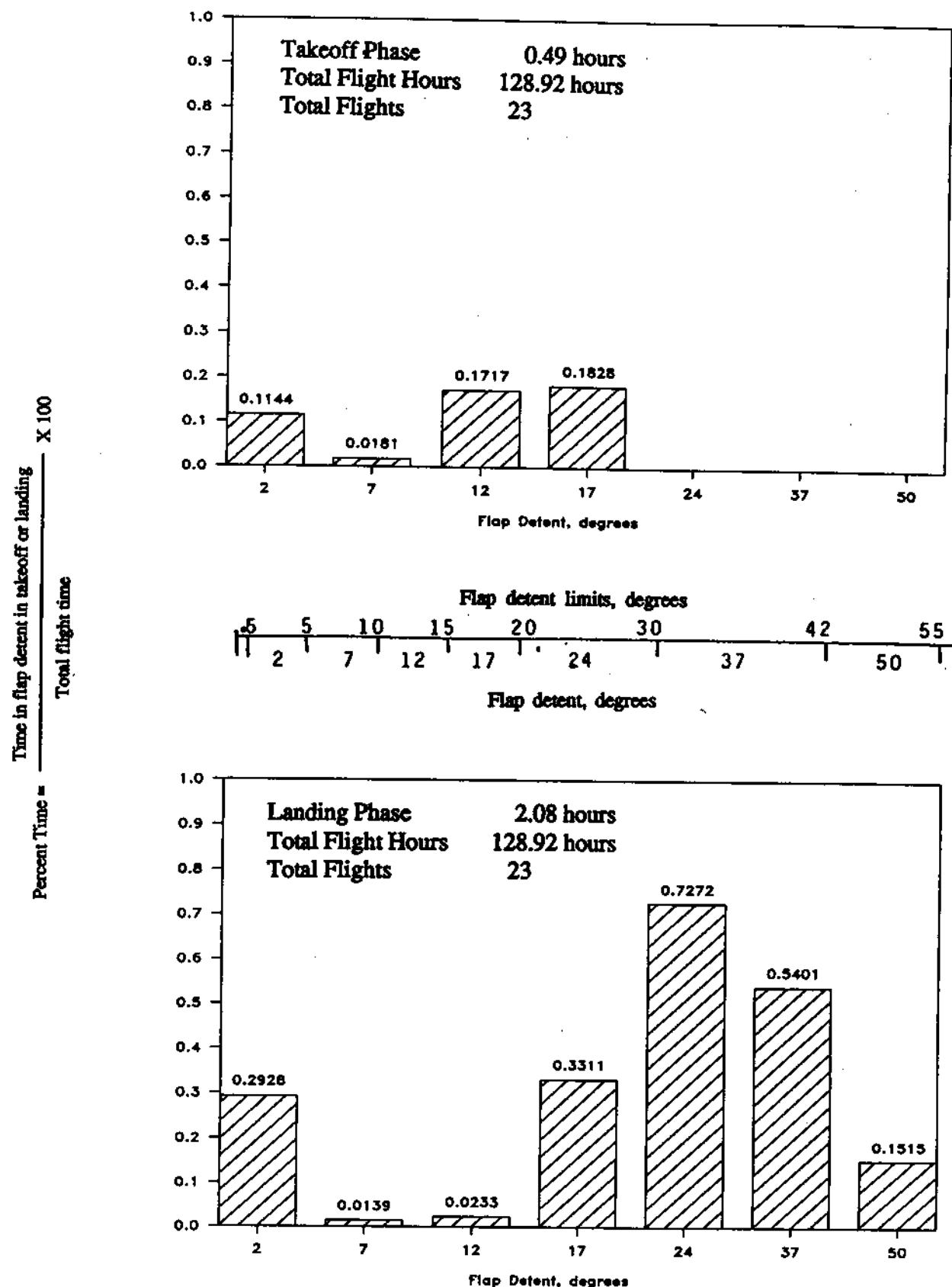
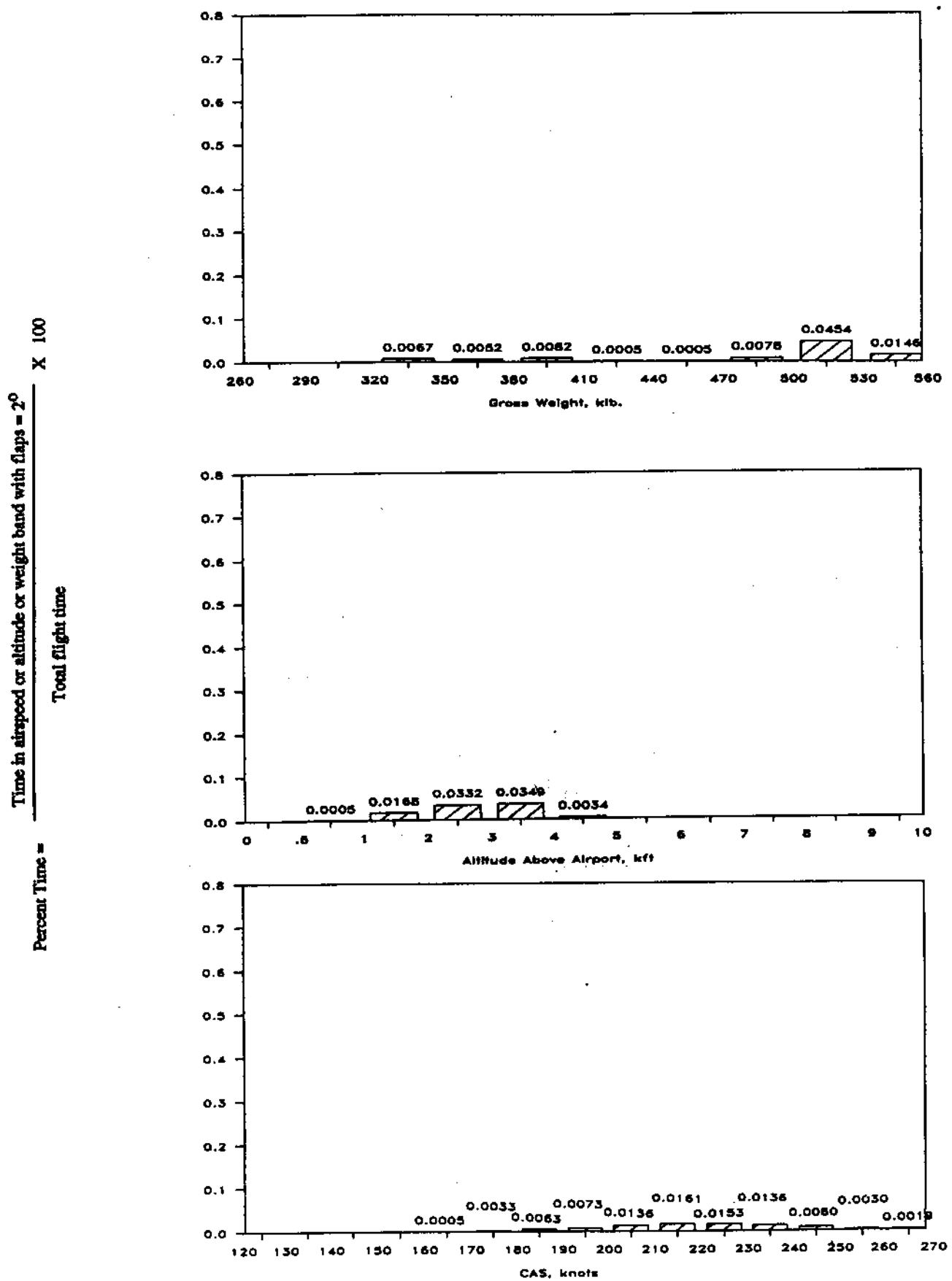
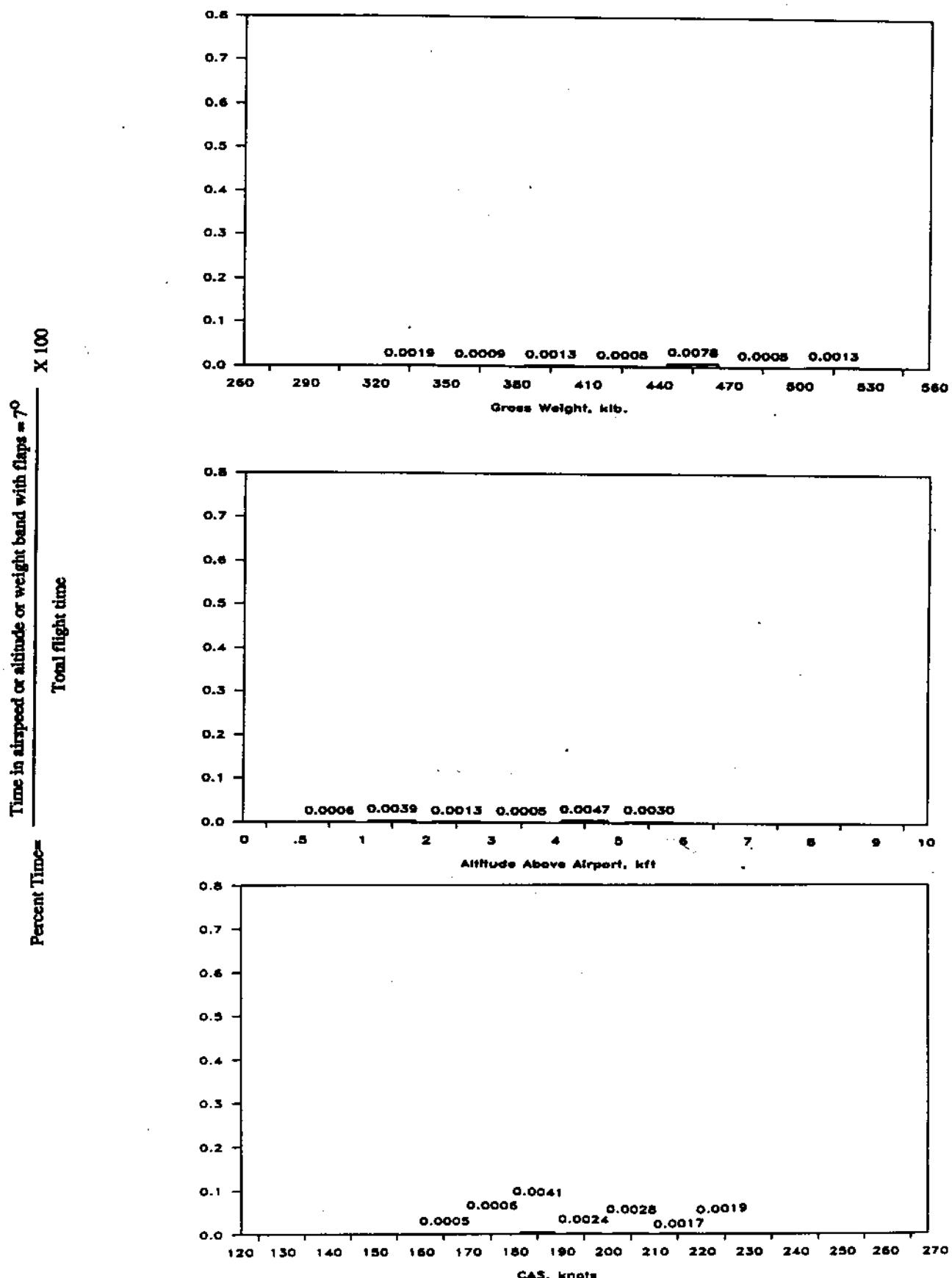


Figure 8.- Percent of total flight time at each flap detent.



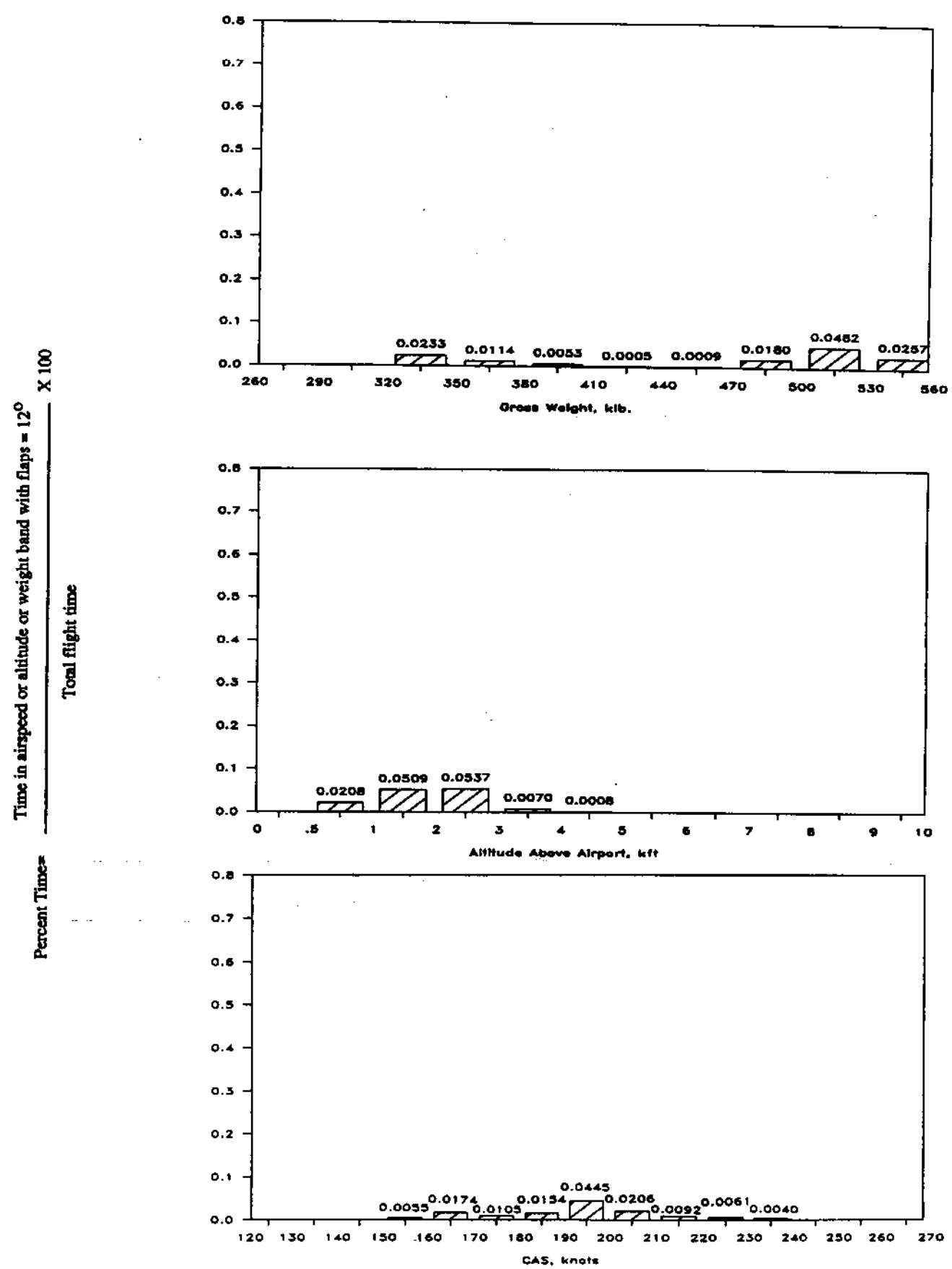
(a) Take off, flaps =  $2^{\circ}$ ; 0.1144 hours

Figure 9.- Gross weight, altitude above airport, and airspeed time distributions.



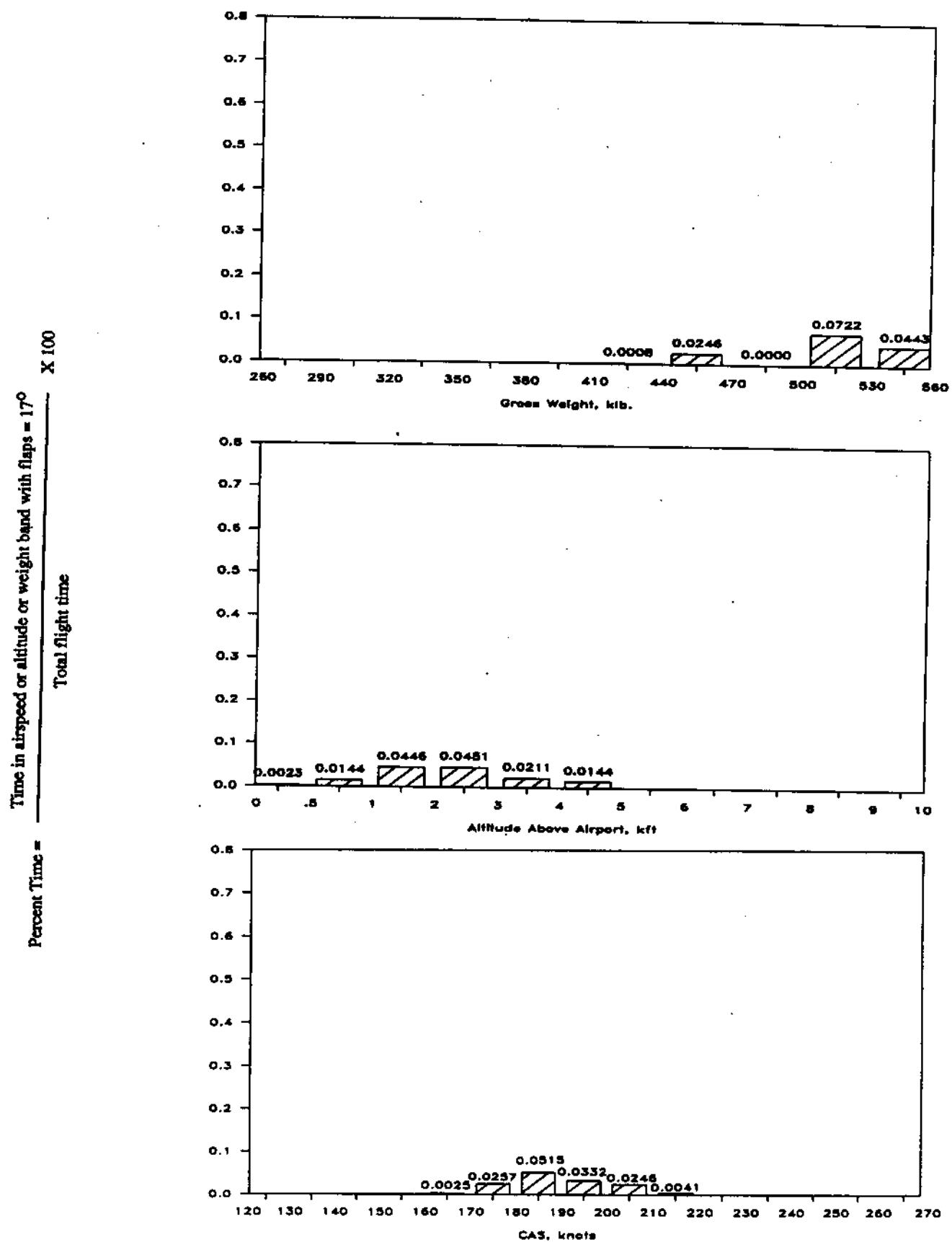
(b) Take off, flaps =  $7^{\circ}$ ; 0.0181 hours

Figure 9. - Continued.



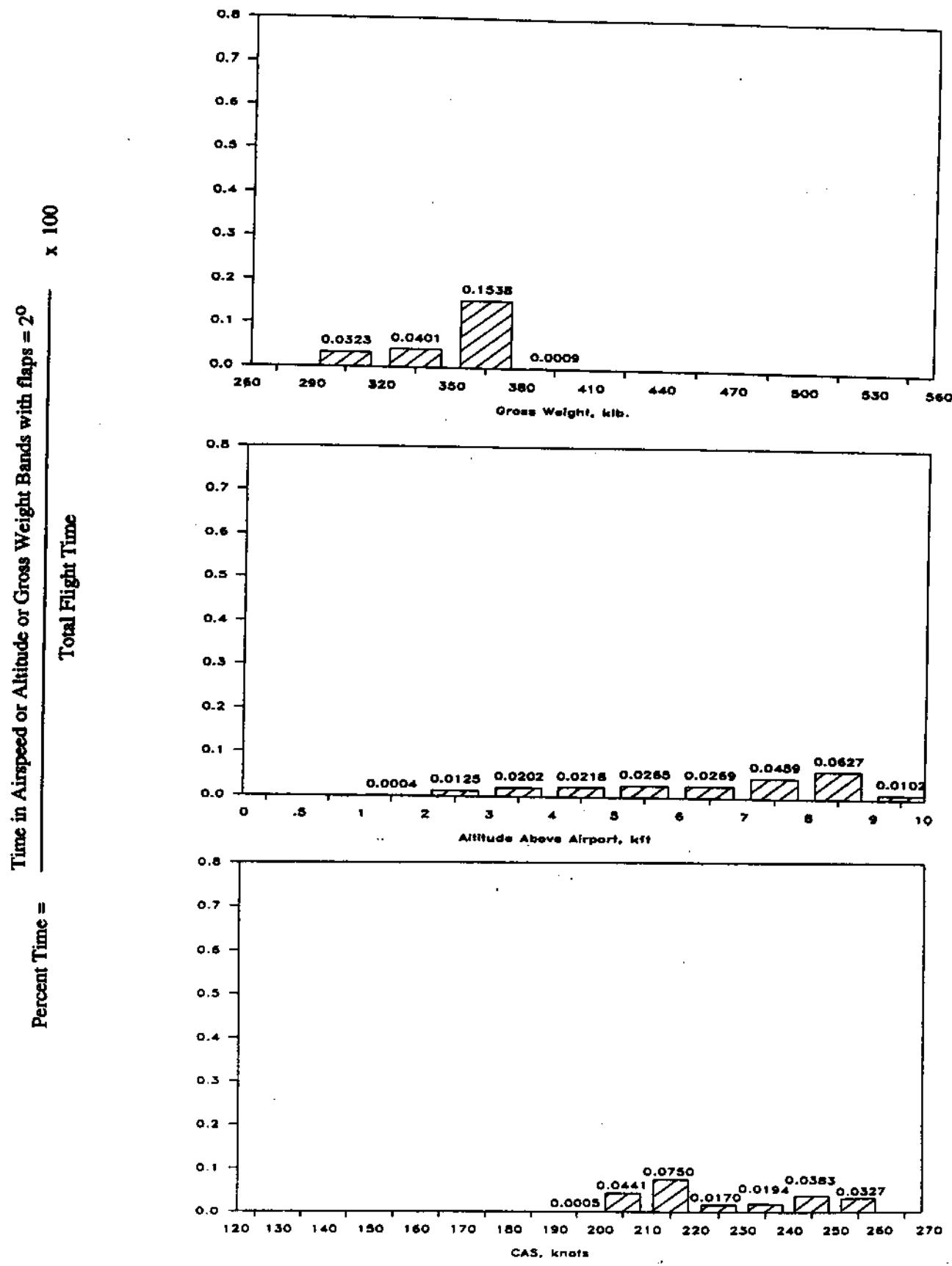
(c) Take off, flaps = 12°; 0.1717 hours

Figure 9.- Continued.



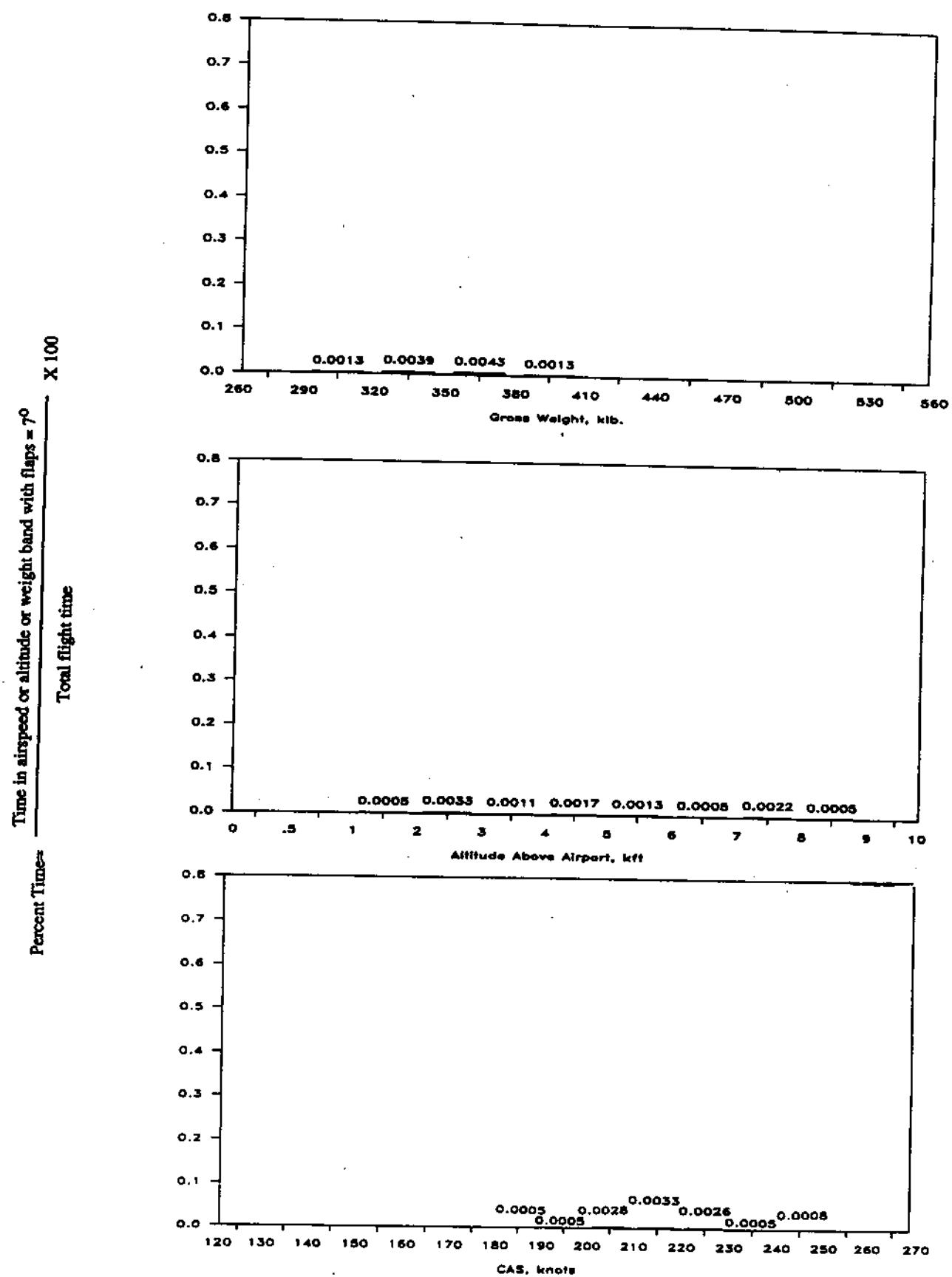
(d) Take off, flaps =  $17^{\circ}$ ; 0.1828 hours

Figure 9.- Continued.



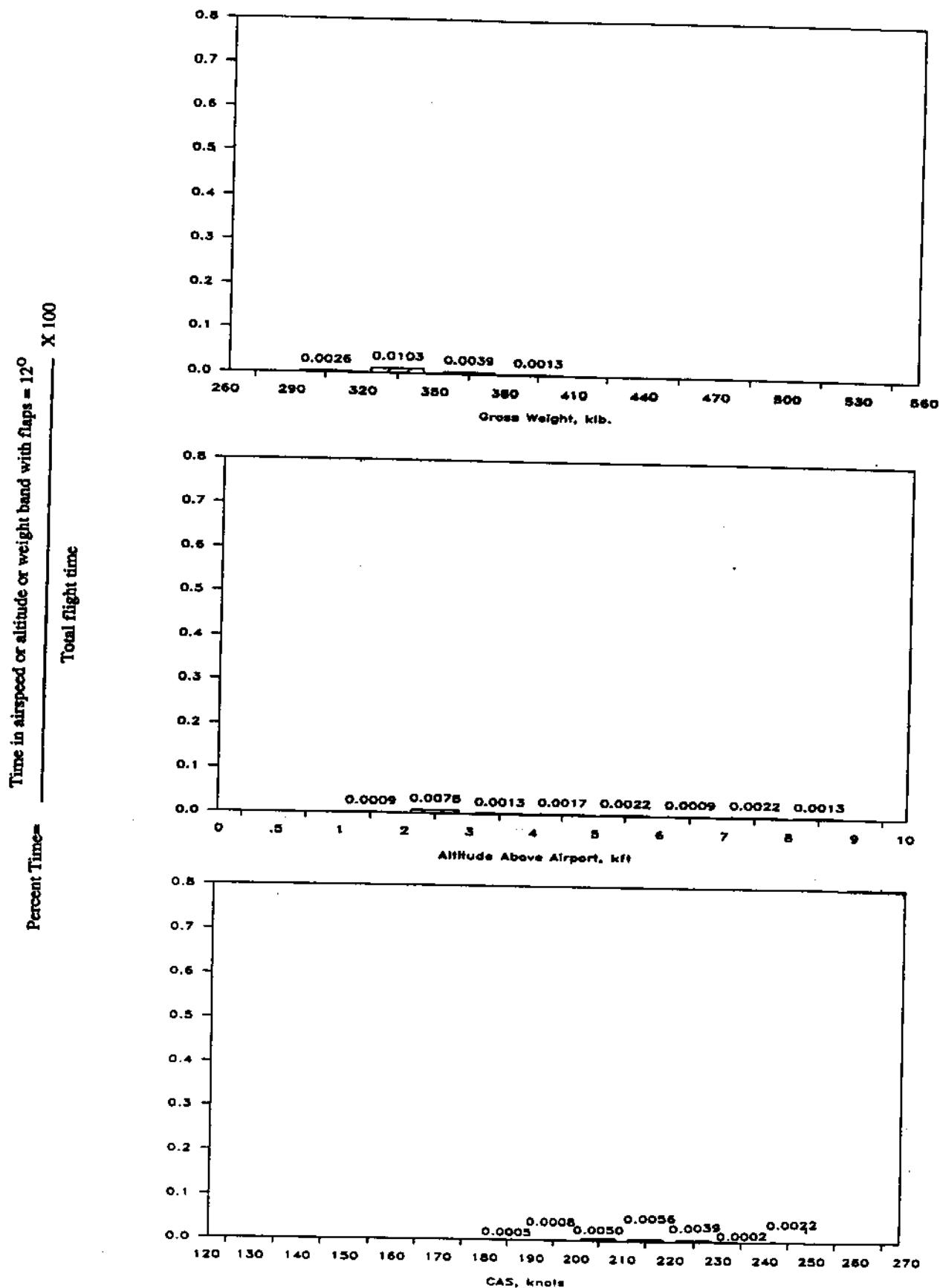
(e) Landing, flaps = 2°; 0.2928 hours

Figure 9. - Continued.



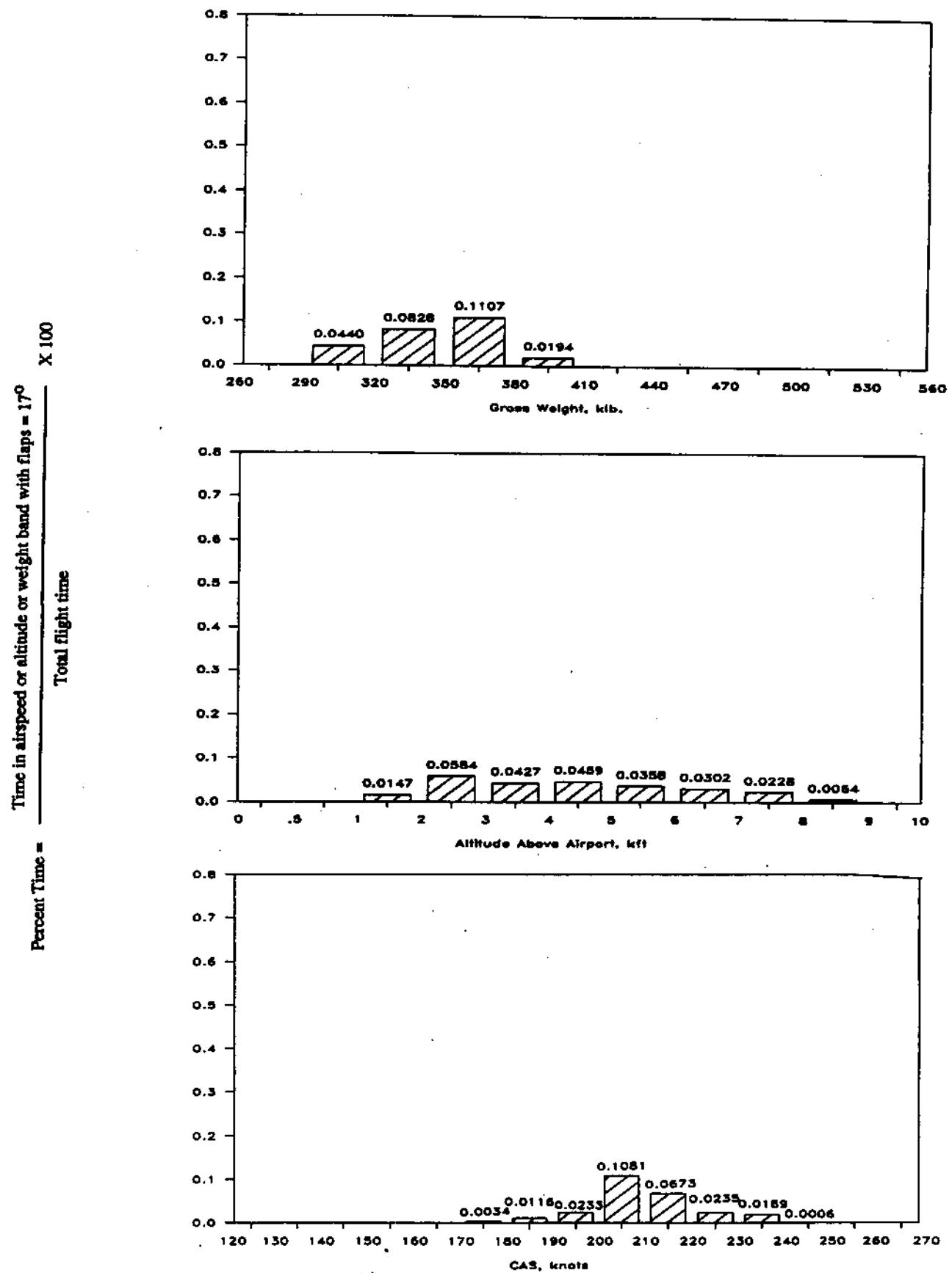
(f) Landing, flaps = 7°; 0.0139 hours

Figure 9. - Continued.



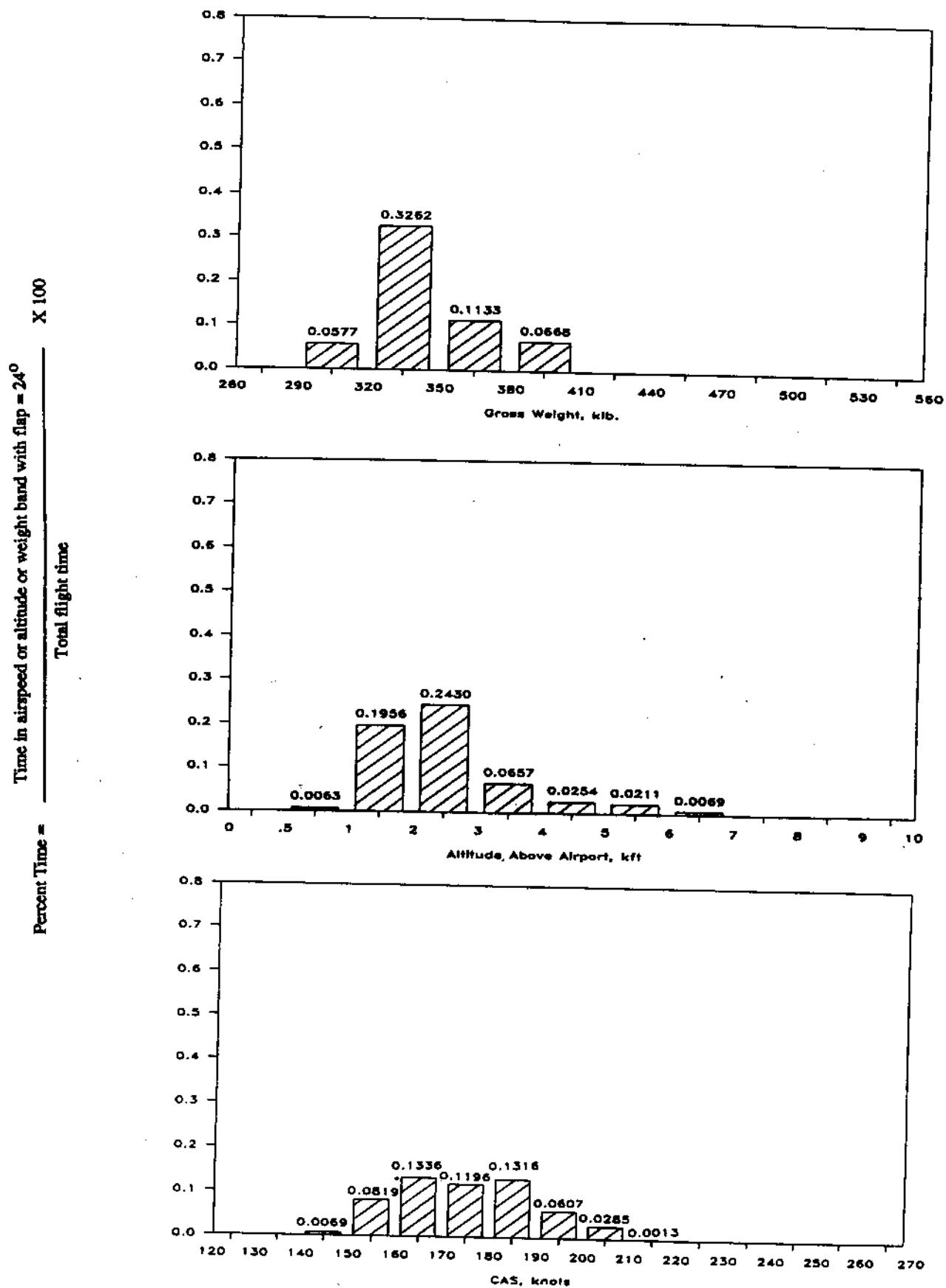
(g) Landing, flaps = 12°; 0.0233 hours

Figure 9. - Continued.



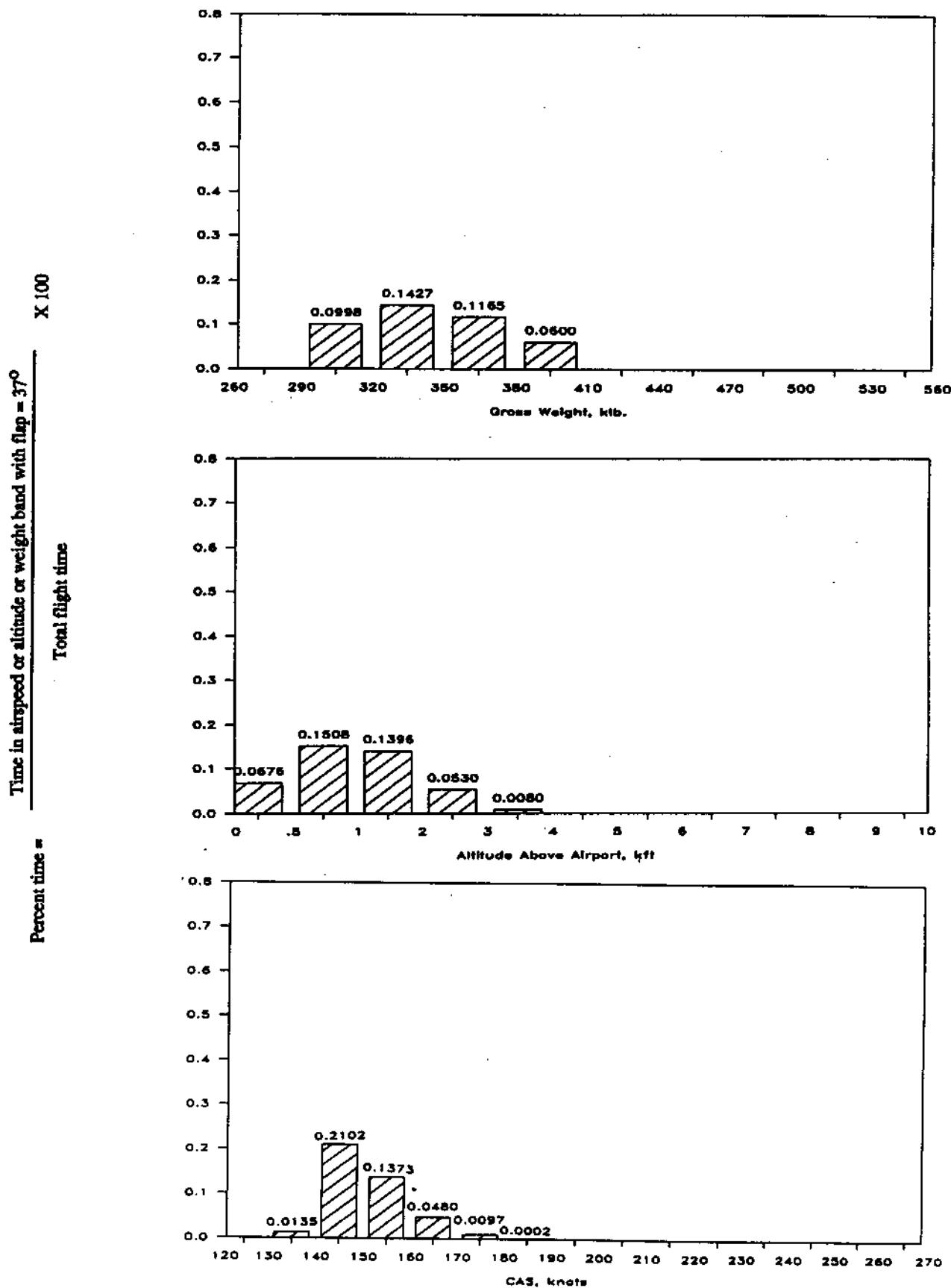
(h) Landing, flaps = 17°; 0.3311 hours

Figure 9. - Continued.



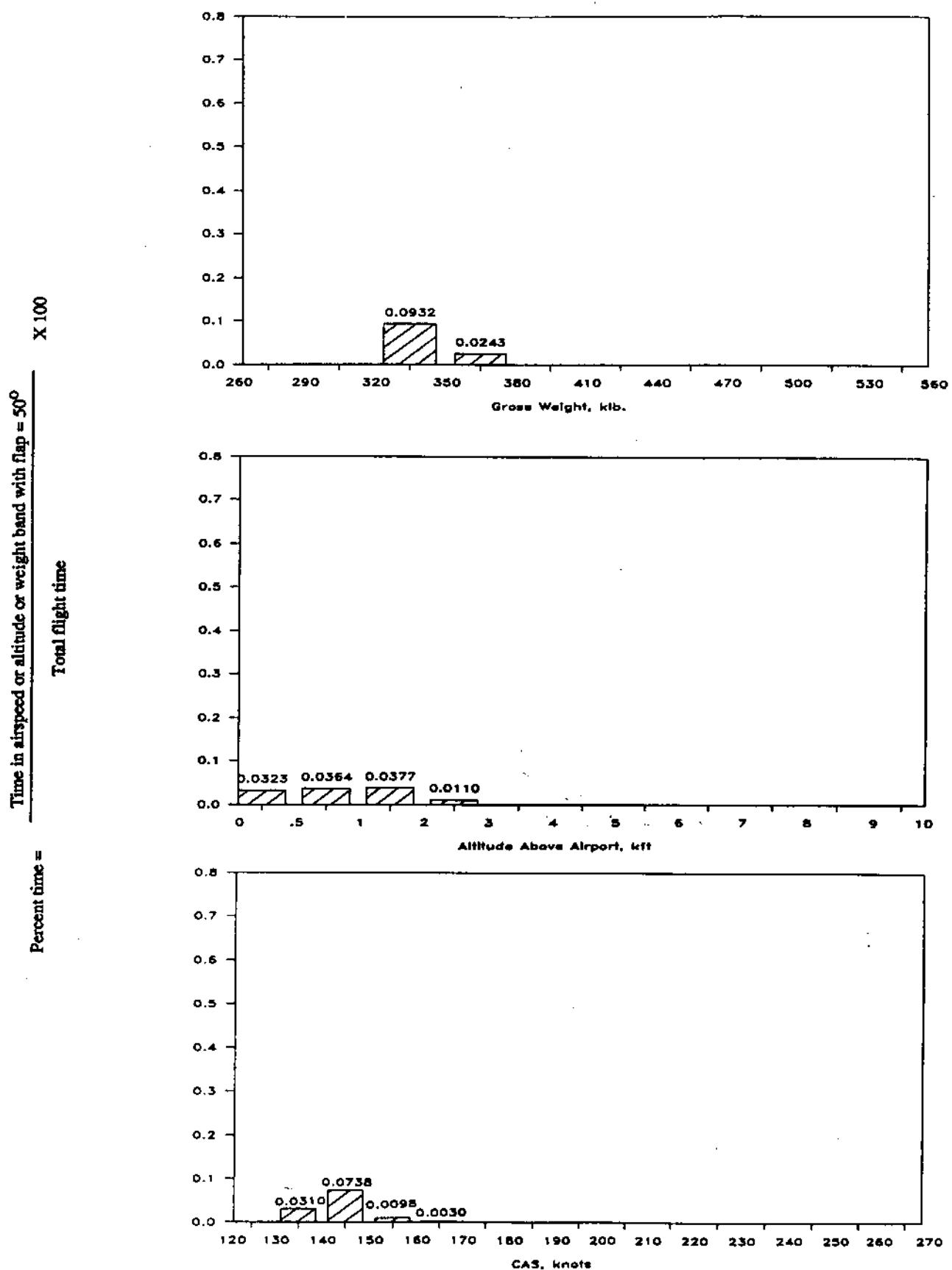
(i) Landing, flaps = 24°; 0.7272 hours

Figure 9. - Continued.



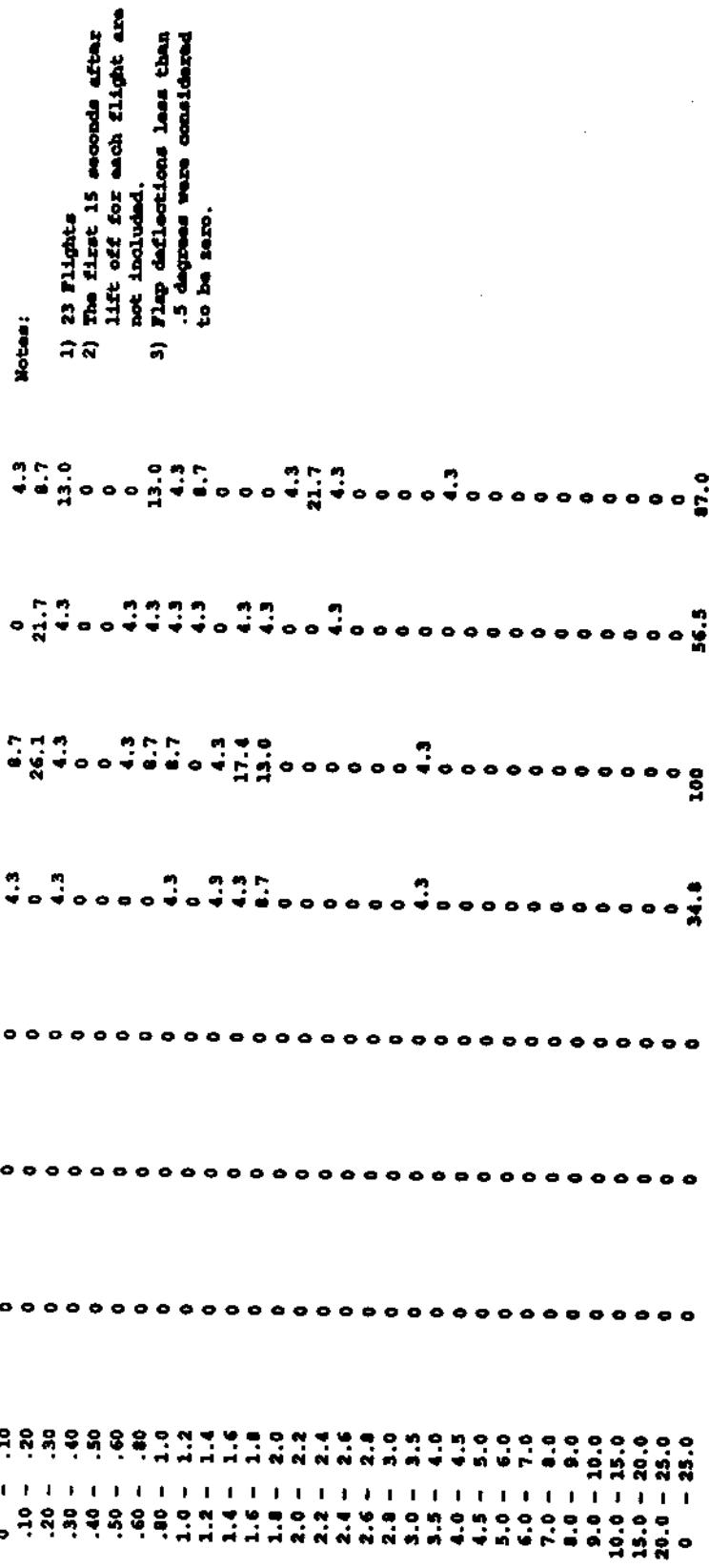
(j) Landing, flaps = 37°; 0.5401 hours

Figure 9. - Continued.



(k) Landing, flaps=50° ; 0.1515 hours

Figure 9. - Concluded.



(a) Take off: Percent of flights vs times when take off flap deflection is reduced below indicated values

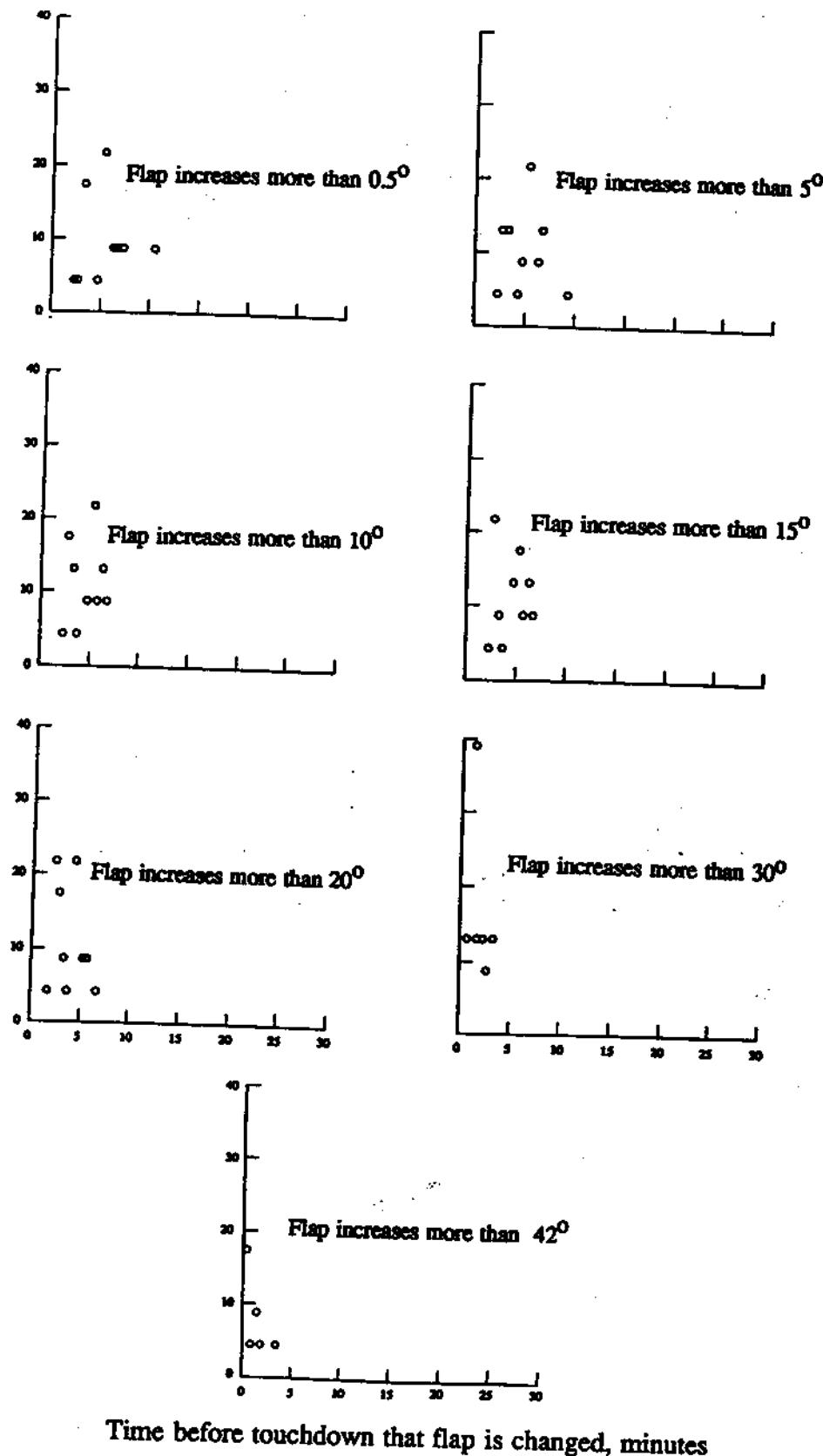
Figure 10.- Flap deflection times.

TIME BEFORE TOUCHDOWN, MINUTES	FLAP DEFLECTION, DEGREES	Notes:				
		10.0	15.0	20.0	30.0	42.0
0 - .50	0	0	0	0	0	17.4
0.5 - 1.0	0	0	0	0	0	4.3
1.0 - 1.5	0	0	0	0	0	39.1
1.5 - 2.0	0	0	0	0	0	8.7
2.0 - 2.5	4.3	4.3	4.3	4.3	4.3	13.0
2.5 - 3.0	4.3	13.0	17.4	21.7	13.0	0
3.0 - 3.5	17.4	13.0	13.0	17.4	8.7	0
3.5 - 4.0	0	0	4.3	4.3	4.3	4.3
4.0 - 4.5	0	0	4.3	0	0	21.7
4.5 - 5.0	4.3	8.7	8.7	13.0	0	0
5.0 - 5.5	21.7	21.7	21.7	17.4	8.7	0
5.5 - 6.0	0	0	8.7	8.7	8.7	0
6.0 - 6.5	4.3	4.3	13.0	13.0	13.0	0
6.5 - 7.0	4.3	13.0	8.7	8.7	8.7	4.3
7.0 - 7.5	8.7	0	0	0	0	0
7.5 - 8.0	0	0	0	0	0	0
8.0 - 8.5	0	0	0	0	0	0
8.5 - 9.0	0	0	0	0	0	0
9.0 - 9.5	0	0	0	0	0	0
9.5 - 10.0	0	0	0	0	0	0
10.0 - 11.0	8.7	0	0	0	0	0
11.0 - 12.0	0	0	0	0	0	0
12.0 - 13.0	0	0	0	0	0	0
13.0 - 14.0	0	0	0	0	0	0
14.0 - 15.0	0	0	0	0	0	0
15.0 - 17.0	0	0	0	0	0	0
17.0 - 19.0	0	0	0	0	0	0
19.0 - 21.0	0	0	0	0	0	0
21.0 - 23.0	0	0	0	0	0	0
23.0 - 25.0	0	0	0	0	0	0
25.0 - 30.0	0	0	0	0	0	0
30.0 - 35.0	0	0	0	0	0	0
35.0 - 40.0	0	0	0	0	0	0
40.0 - 60.0	0	0	0	0	0	0
0 - 60.0	87.0	91.3	100	100	100	39.1

(b) Landing: Percent of flights vs times when landing flap deflection is increased to greater than indicated values

Figure 10.-Continued.

Percent of Flights



Time before touchdown that flap is changed, minutes

(c) Landing : Plots of data from Figure 10(b)

Figure 10.- Concluded.

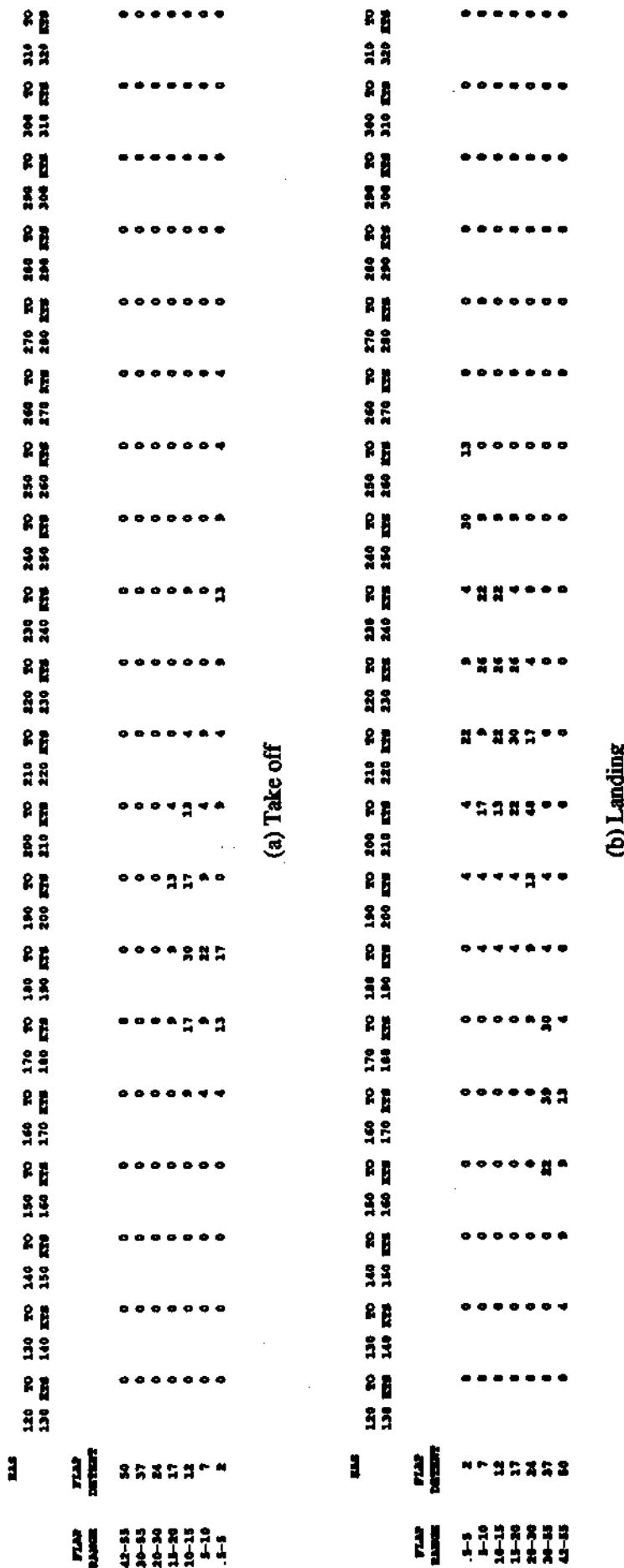


Figure 11.- Percent of flights vs equivalent airspeed at flap detent change.

**NO OCCURRENCES  
in  
23 Flights and 129 Hours**

**Figure 12.- Flap use above 10,000 feet altitude.**

(x) a Level crossing counts per hour within pressure altitude bands

Figure 13.- Normal acceleration exceedances.

LEVEL	PRESSURE ALTITUDE BANDS									
	-500 TO 4500 FT	500 TO 9500 FT	1500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT	44500 TO 49500 FT	-500 TO 4500 FT
5'5	0	0	0	0	0	0	0	0	0	0
1.60	0	0	0	0	0	0	0	0	0	0
1.40	0	0	0	0	0	0	0	0	0	0
1.20	0	0	0	0	0	0	0	0	0	0
1.00	0	0	0	0	0	0	0	0	0	0
.80	0	0	0	0	0	0	0	0	0	0
.70	0	0	0	0	0	0	0	0	0	0
.60	0	0	0	0	0	0	0	0	0	0
.50	0	0	0	0	0	0	0	0	0	0
.40	0	0	0	0	0	0	0	0	0	0
.30	0	0	0	0	0	0	0	0	0	0
.20	0	0	0.39	0.41	0	0	0	0	0	0.02
.15	2.49	4.69	0.82	0.34	0	0	0	0	0	0.19
.10	12.44	14.47	7.78	2.62	1.14	0.21	0.12	0	0	0.83
.05	41.93	35.59	23.76	15.02	4.72	1.39	0.72	0.21	0	2.93
0	126.13	101.30	106.09	110.27	116.04	72.98	96.11	104.13	100.05	100.05
-.05	41.93	25.03	16.02	15.95	14.41	1.47	9.58	0.51	2.86	2.86
-.10	8.86	5.87	1.64	2.82	2.28	0.21	0.05	0.05	0	0
-.15	2.49	0.78	0	0.47	0	0	0.02	0	0	0.09
-.20	0	0	0	0	0	0	0	0	0	0
-.30	0	0	0	0	0	0	0	0	0	0
-.40	0	0	0	0	0	0	0	0	0	0
-.50	0	0	0	0	0	0	0	0	0	0
-.60	0	0	0	0	0	0	0	0	0	0
-.70	0	0	0	0	0	0	0	0	0	0
-.80	0	0	0	0	0	0	0	0	0	0
-.90	0	0	0	0	0	0	0	0	0	0
-1.00	0	0	0	0	0	0	0	0	0	0
-1.20	0	0	0	0	0	0	0	0	0	0
-1.40	0	0	0	0	0	0	0	0	0	0
-1.60	0	0	0	0	0	0	0	0	0	0
FLIGHT HOURS & AVG	2.81	2.56	2.44	2.13	2.64	9.55	41.46	65.32	0	120.92
FLIGHT MILES & AVG	561.49	714.53	878.79	879.09	1187.79	4638.71	19917.03	31127.09	0	59904.53
<b>TOTAL FLIGHTS</b>										<b>2</b>
<b>TOTAL FLIGHT MILES FLIES UP AND DOWN</b>										<b>128.82</b>
<b>TOTAL FLIGHT MILES FLIES UP AND DOWN</b>										<b>59904.53</b>

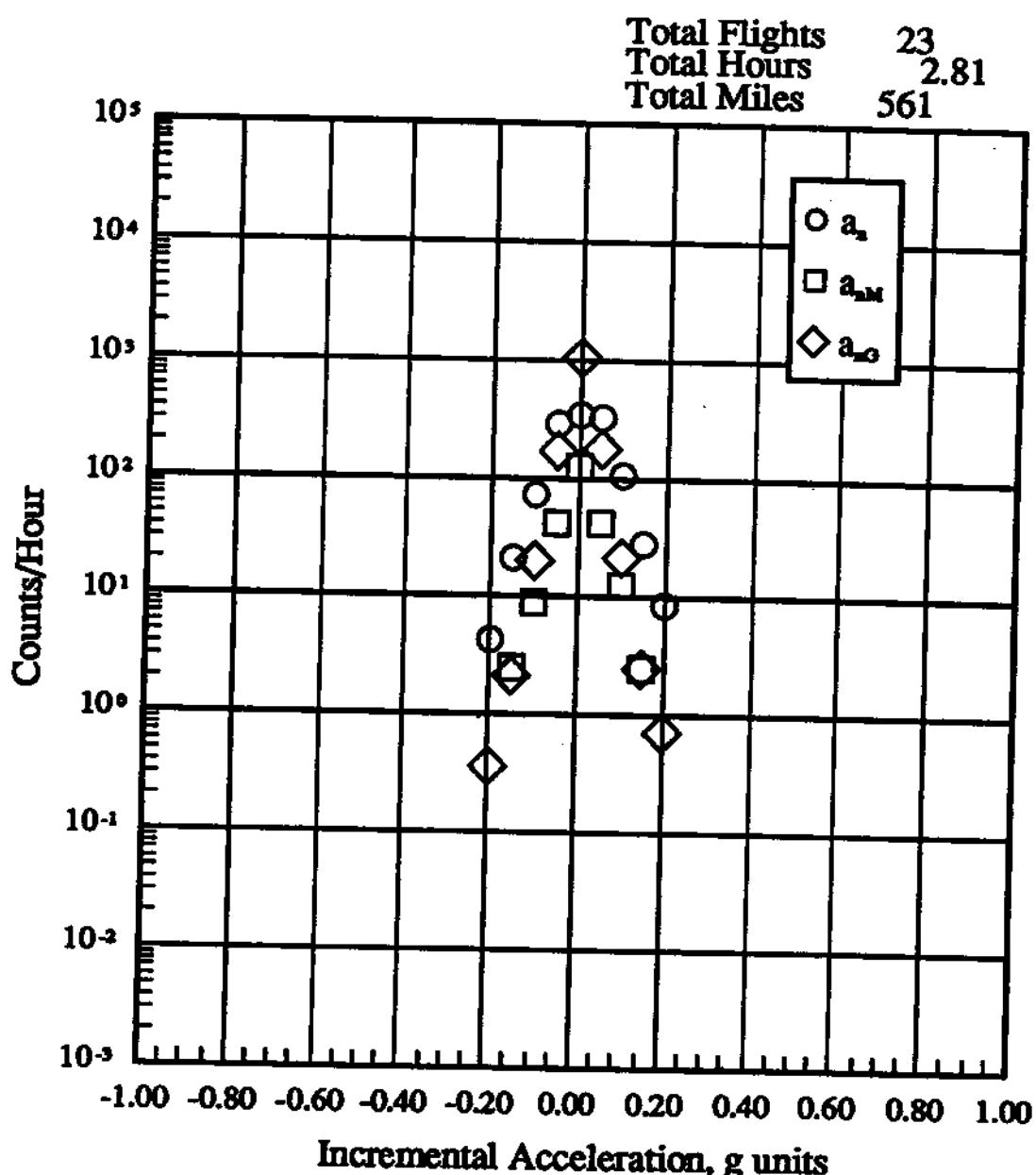
(b) 4-m Level crossing counts per hour within pressure altitude bands

Figure 13.- Continued.

a <sub>HG</sub> LEVEL	PRESSURE ALTITUDE BANDS									-500 TO 44500 FT		
	-500 TO 4500 FT	4500 TO 5500 FT	5500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT	-500 TO 44500 FT		
.975	0	0	0	0	0	0	0	0	0	0	0	0
1.60	0	0	0	0	0	0	0	0	0	0	0	0
1.40	0	0	0	0	0	0	0	0	0	0	0	0
1.20	0	0	0	0	0	0	0	0	0	0	0	0
1.00	0	0	0	0	0	0	0	0	0	0	0	0
.80	0	0	0	0	0	0	0	0	0	0	0	0
.70	0	0	0	0	0	0	0	0	0	0	0	0
.60	0	0	0	0	0	0	0	0	0	0	0	0
.50	0	0	0	0	0	0	0	0	0	0	0	0
.40	0	0	0	0	0	0	0	0	0	0	0	0
.30	0	0	0	0	0	0	0	0	0	0	0	0
.20	0	0	0	0	0	0	0	0	0	0	0	0
.15	2.49	3.19	1.96	0.41	0.47	0.38	0.38	0.10	0.05	0.14	0.26	0.09
.10	21.32	12.13	5.73	1.52	6.10	1.52	0.84	0.63	0.86	1.84	1.50	1.02
.05	178.01	68.06	45.47	44.11	24.27	7.12	9.12	8.36	1647.90	1646.40	1607.05	14.95
0	1061.64	1242.24	1302.95	1427.89	1498.70	1566.51	1647.90	1646.40	1647.90	1646.40	1607.05	14.95
-.05	177.26	68.06	49.15	47.39	21.62	7.22	8.37	8.51	8.51	8.51	8.51	1.62
-.10	15.90	12.13	5.73	7.04	3.79	0.63	0.39	0.93	0.93	0.93	0.93	0.29
-.15	2.13	4.30	0.41	0.94	0.76	0.10	0.07	0.18	0.18	0.18	0.18	0.06
-.20	0.36	0.39	0.41	0	0	0.10	0.10	0	0	0	0	0
-.30	0	0	0	0	0	0	0	0	0	0	0	0
-.40	0	0	0	0	0	0	0	0	0	0	0	0
-.50	0	0	0	0	0	0	0	0	0	0	0	0
-.60	0	0	0	0	0	0	0	0	0	0	0	0
-.70	0	0	0	0	0	0	0	0	0	0	0	0
-.80	0	0	0	0	0	0	0	0	0	0	0	0
-.90	0	0	0	0	0	0	0	0	0	0	0	0
-1.00	0	0	0	0	0	0	0	0	0	0	0	0
-1.20	0	0	0	0	0	0	0	0	0	0	0	0
-1.40	0	0	0	0	0	0	0	0	0	0	0	0
-1.60	0	0	0	0	0	0	0	0	0	0	0	0
FLIGHT HOURS @ ALT	2.81	2.56	2.44	2.13	2.64	9.55	41.46	65.32	0	126.92		
FLIGHT MILES @ ALT	561.49	714.53	878.79	879.09	1187.79	4638.71	19917.03	31127.09	0	59904.53		
TOTAL FLIGHTS									23			
TOTAL FLIGHT HOURS FLAPS UP AND DOWN									126.92			
TOTAL FLIGHT MILES FLAPS UP AND DOWN									59904.53			

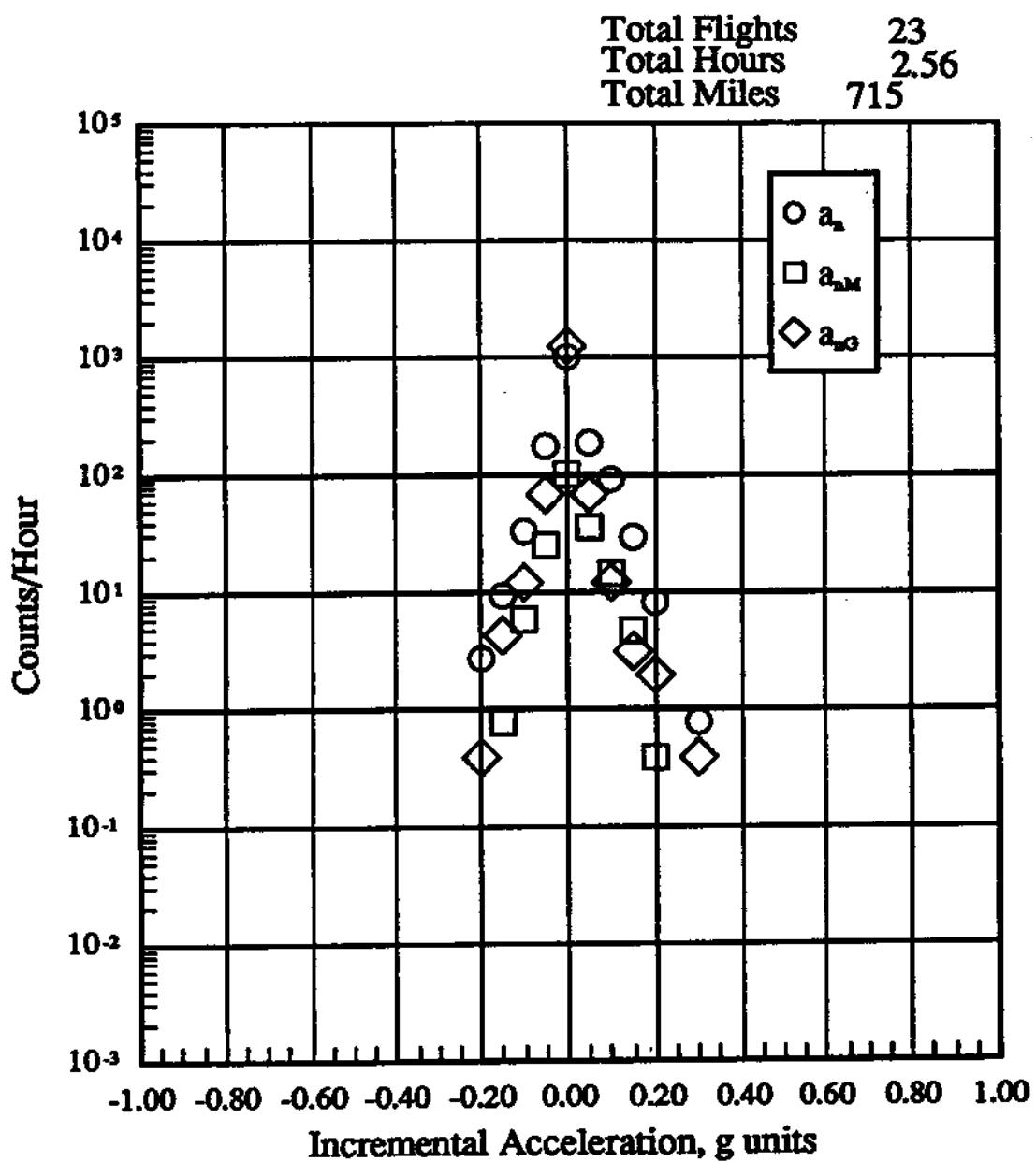
(c) a<sub>HG</sub> Level crossing counts per hour within pressure altitude bands

Figure 13.- Continued.



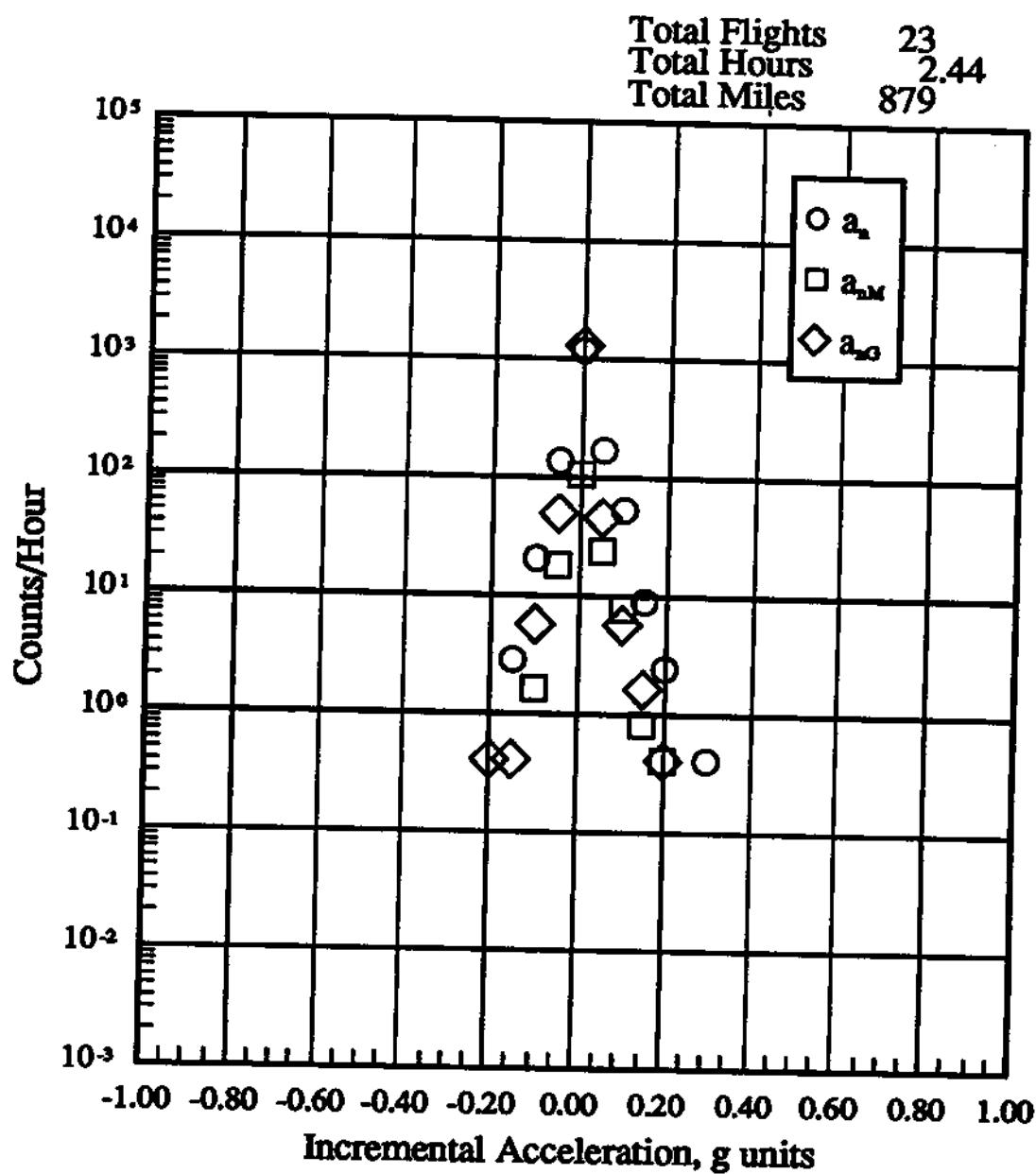
(d)  $a_x$ ,  $a_M$ ,  $a_G$ , -500 to 4500 feet altitude

Figure 13.- Continued.



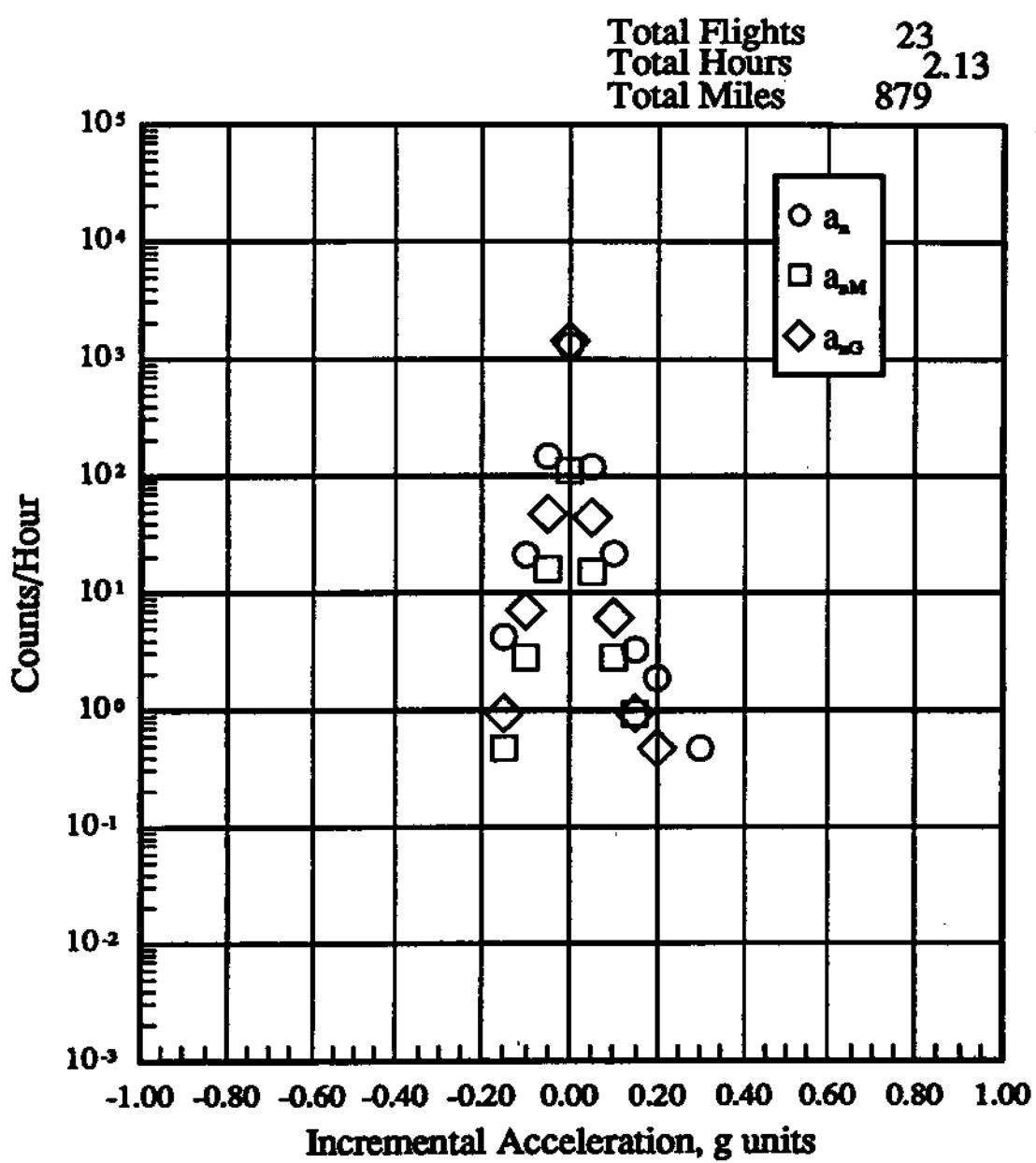
(e)  $a_s$ ,  $a_M$ ,  $a_G$ , 4500 to 9500 feet altitude

Figure 13.- Continued.



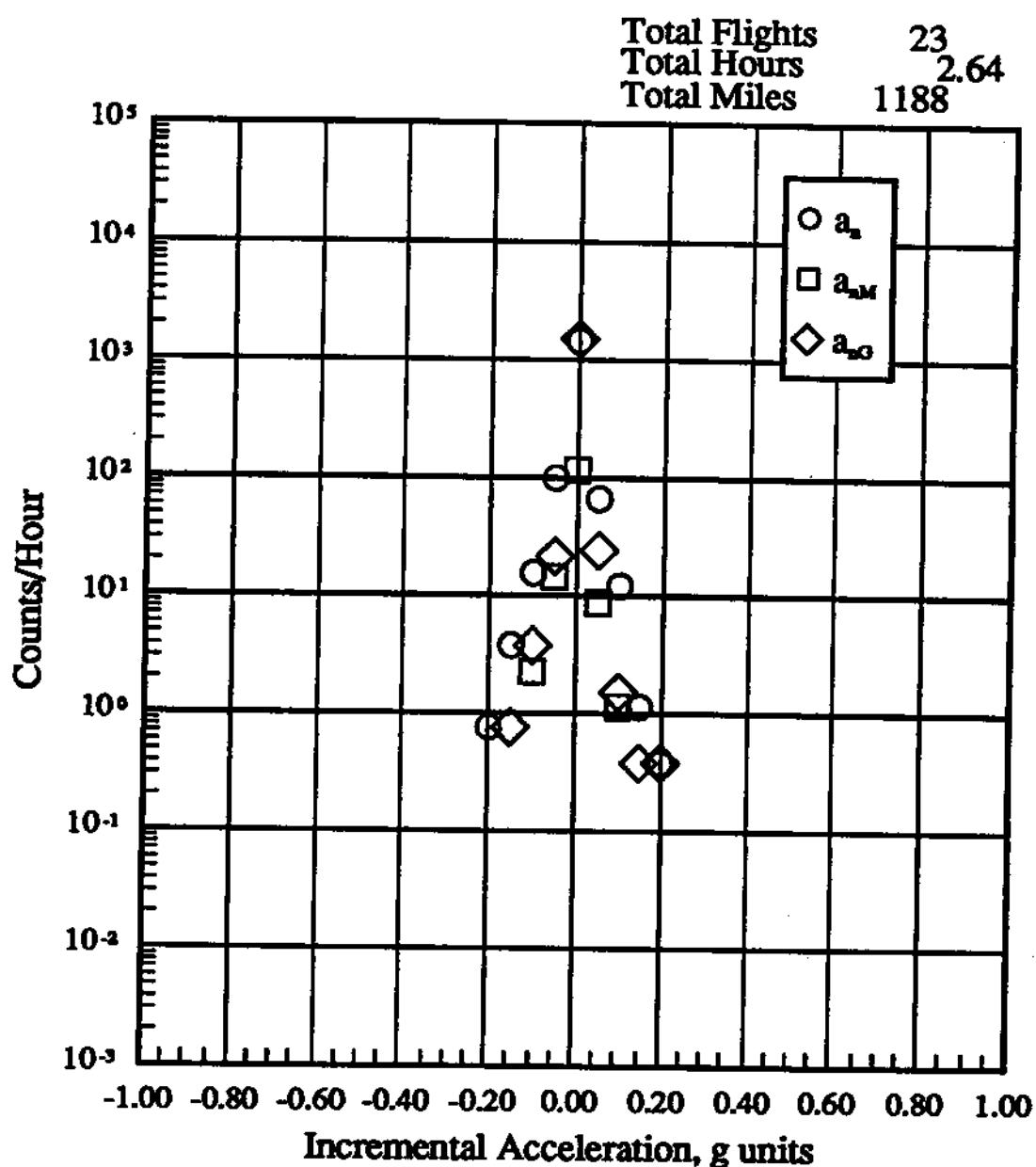
(f)  $a_s$ ,  $a_M$ ,  $a_G$ , 9500 to 14500 feet altitude

Figure 13.- Continued.



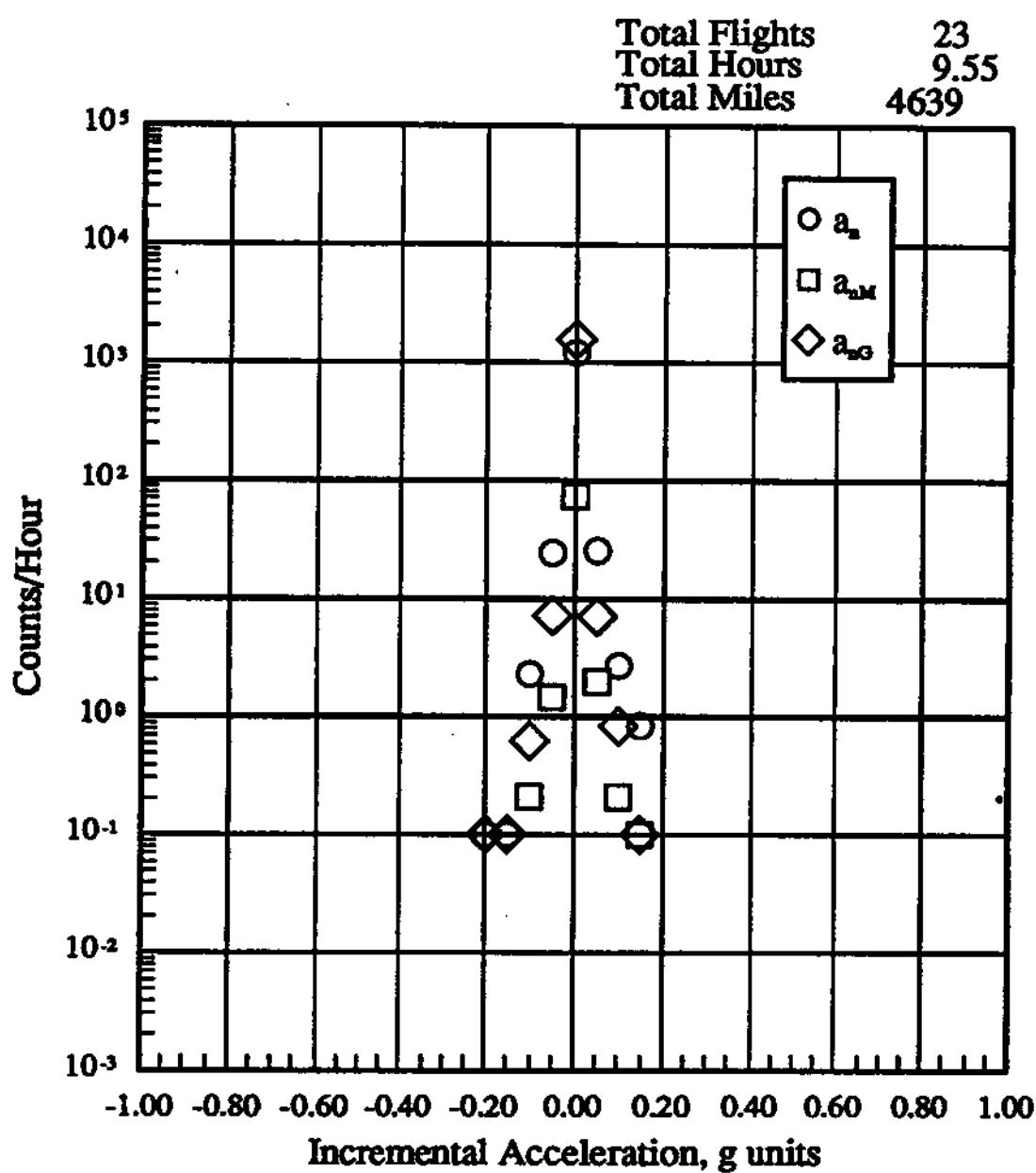
(g)  $a_x$ ,  $a_M$ ,  $a_G$ , 14500 to 19500 feet altitude

Figure 13.- Continued.



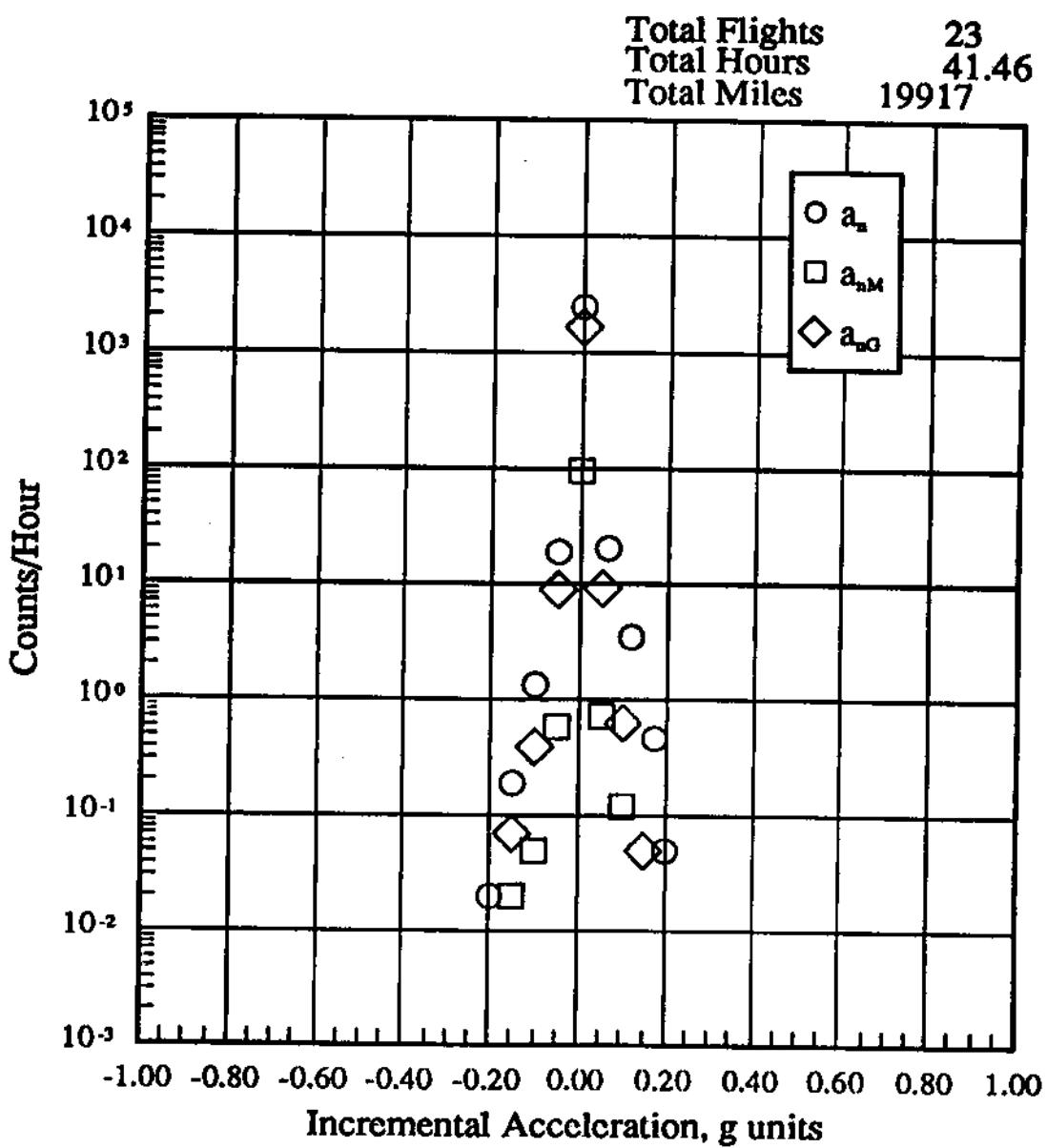
(h)  $a_n$ ,  $a_M$ ,  $a_G$ , 19500 to 24500 feet altitude

Figure 13.- Continued.



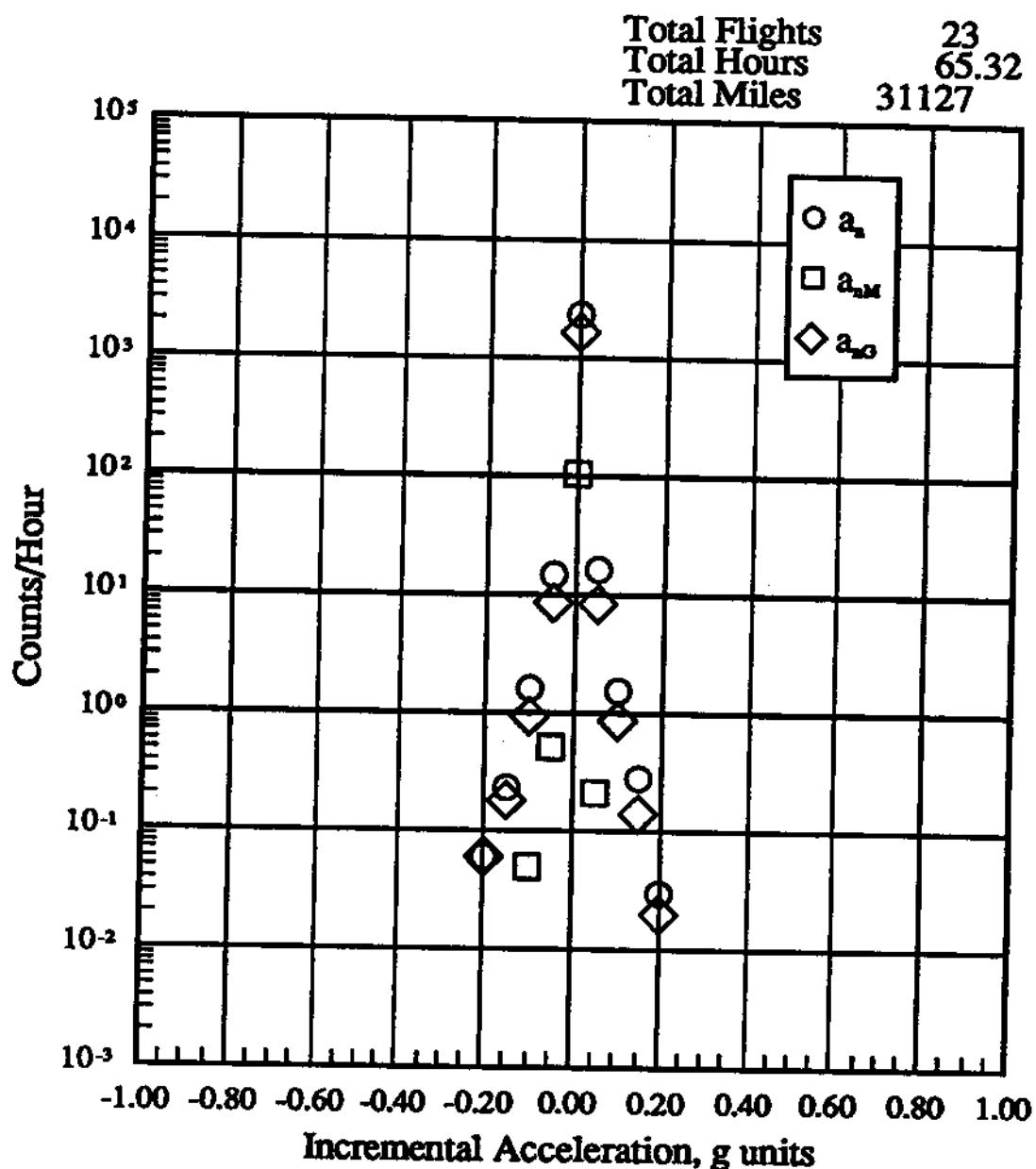
(i)  $a_s$ ,  $a_M$ ,  $a_G$ , 24500 to 29500 feet altitude

Figure 13.- Continued.



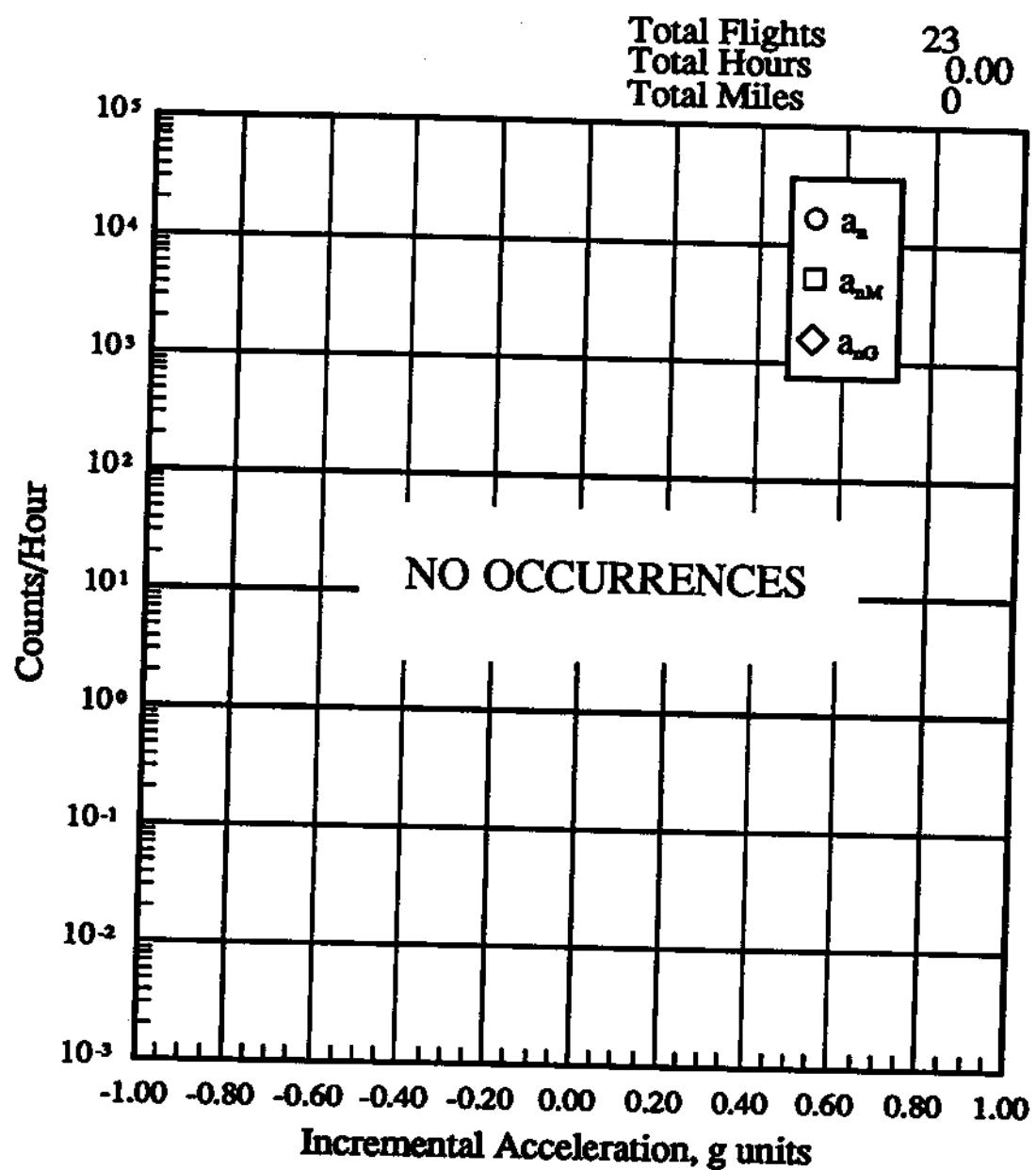
(j)  $a_n$ ,  $a_{nM}$ ,  $a_{nO}$ , 29500 to 34500 feet altitude

Figure 13.- Continued.



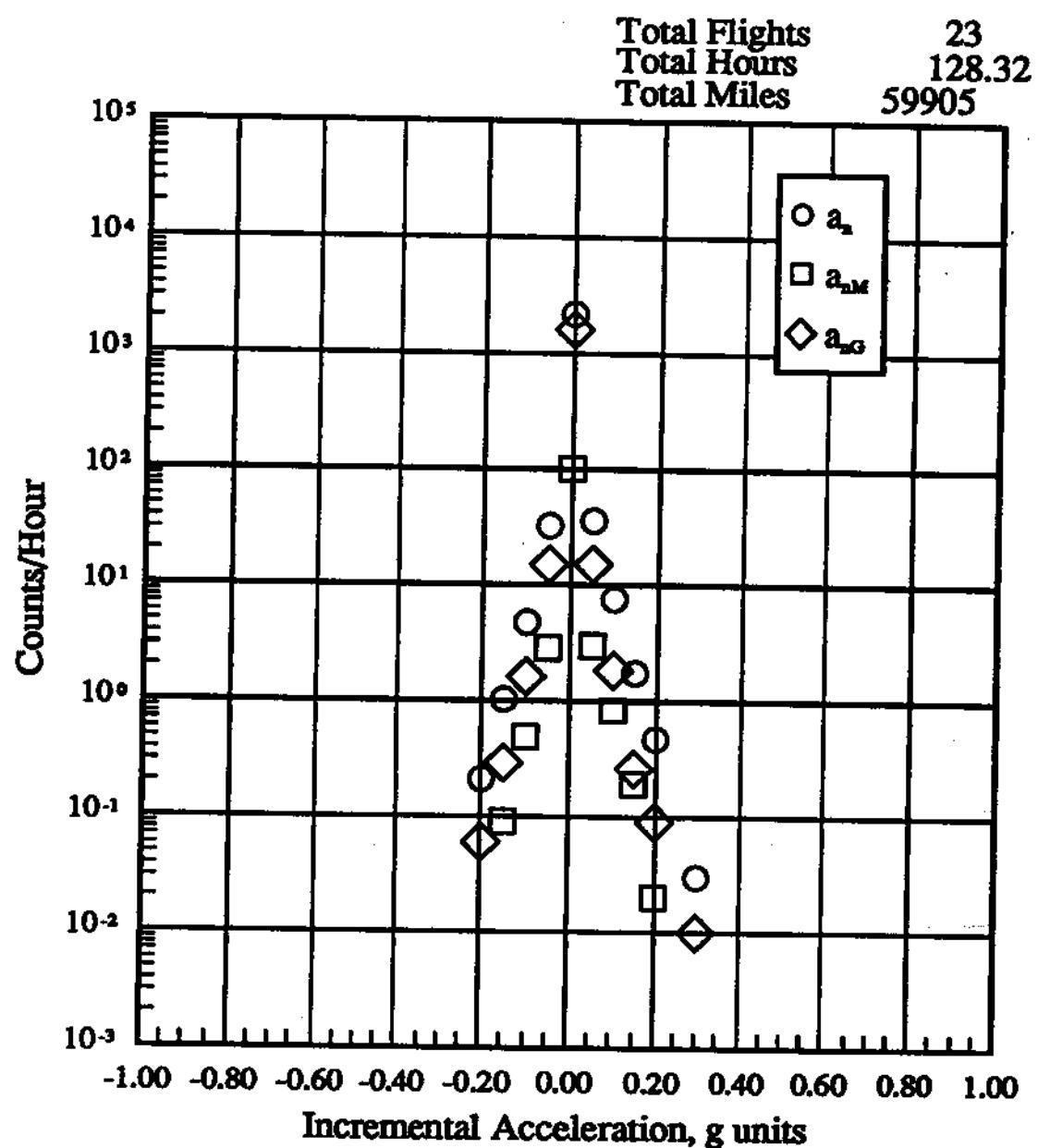
(k)  $a_n$ ,  $a_M$ ,  $a_G$ , 34500 to 39500 feet altitude

Figure 13.- Continued.



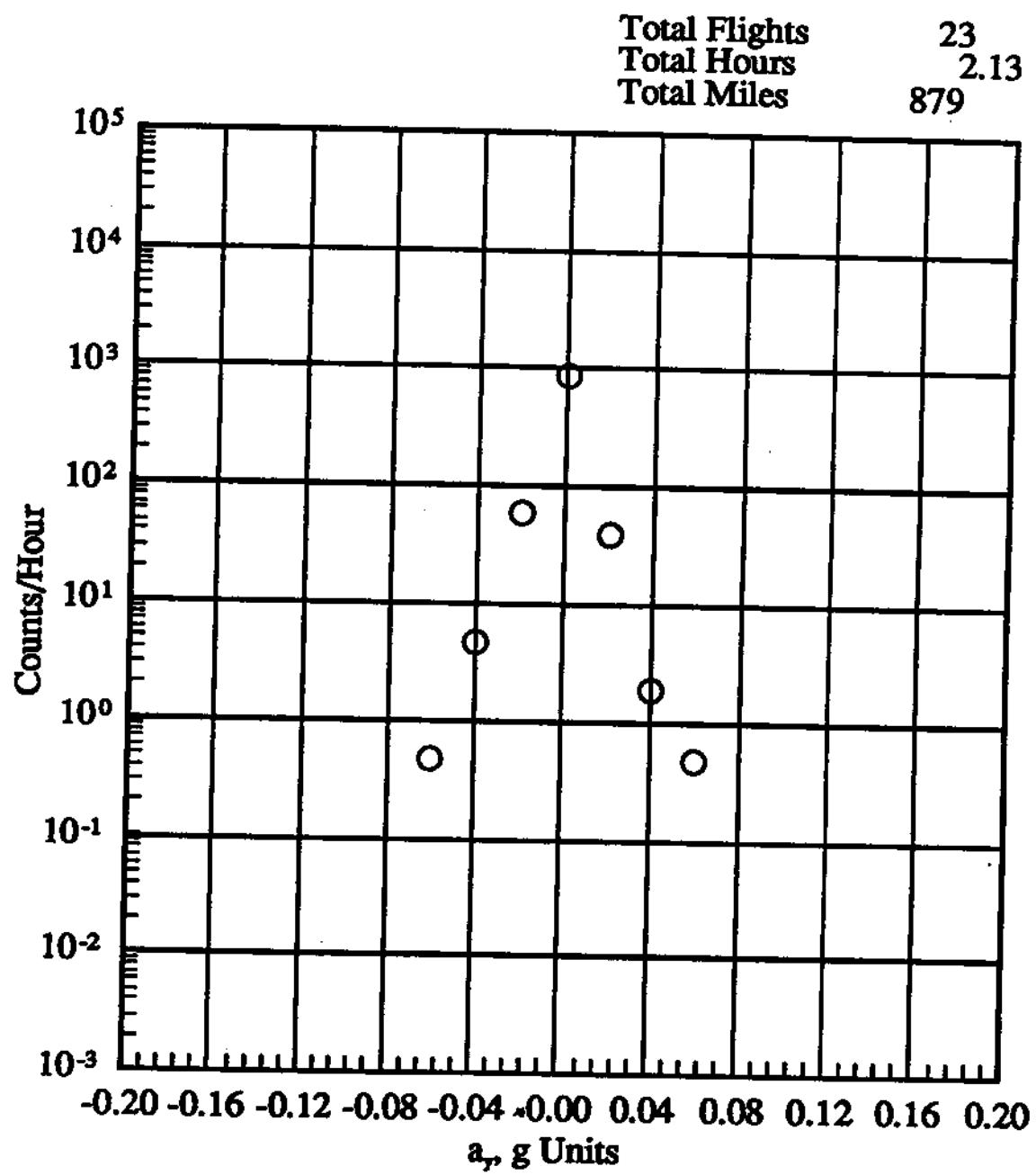
(l)  $a$ ,  $a_M$ ,  $a_O$ , 39500 to 44500 feet altitude

Figure 13.- Continued.



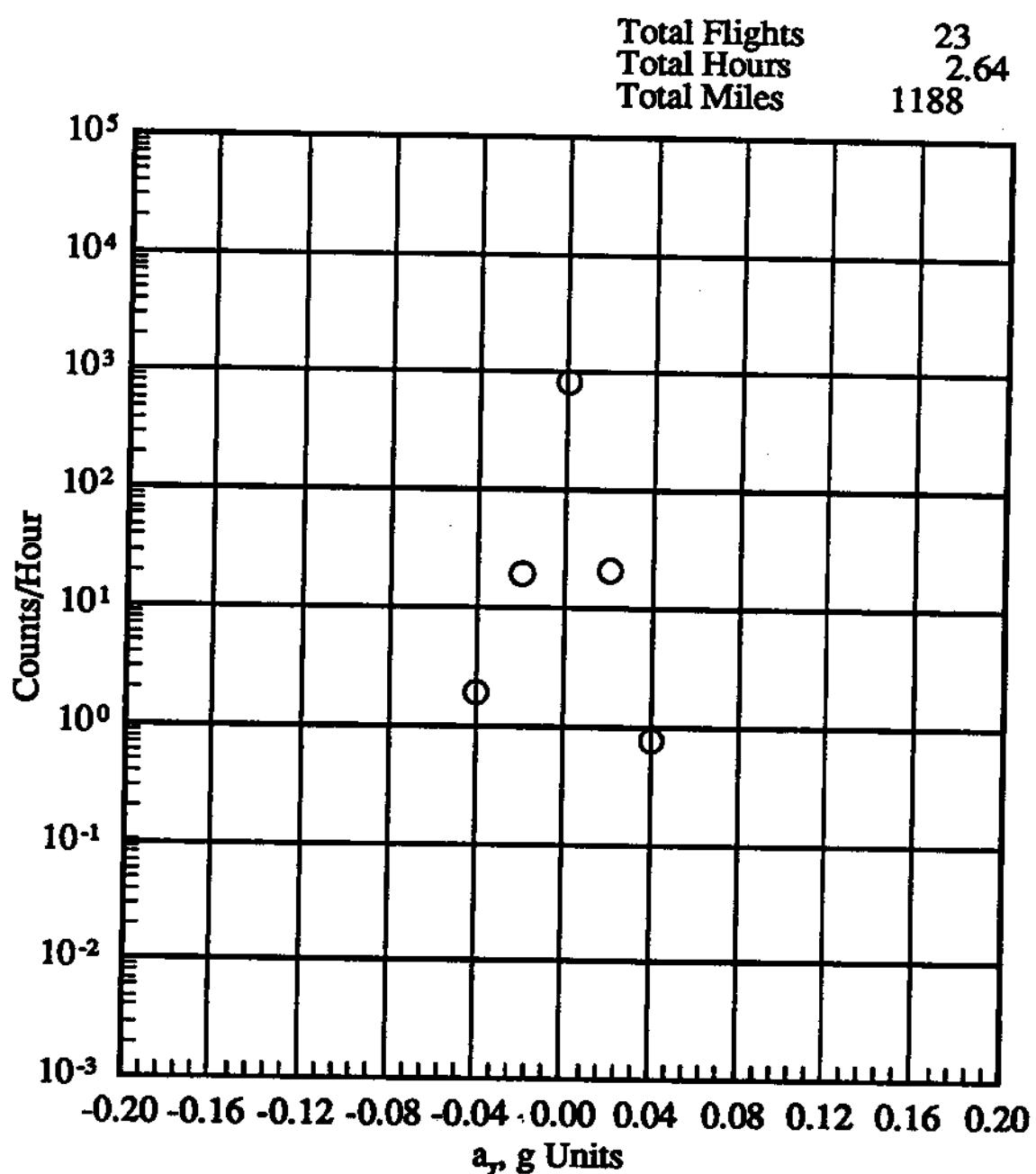
(m)  $a_x$ ,  $a_{xM}$ ,  $a_{xG}$ , -500 to 44500 feet altitude

Figure 13.- Concluded.



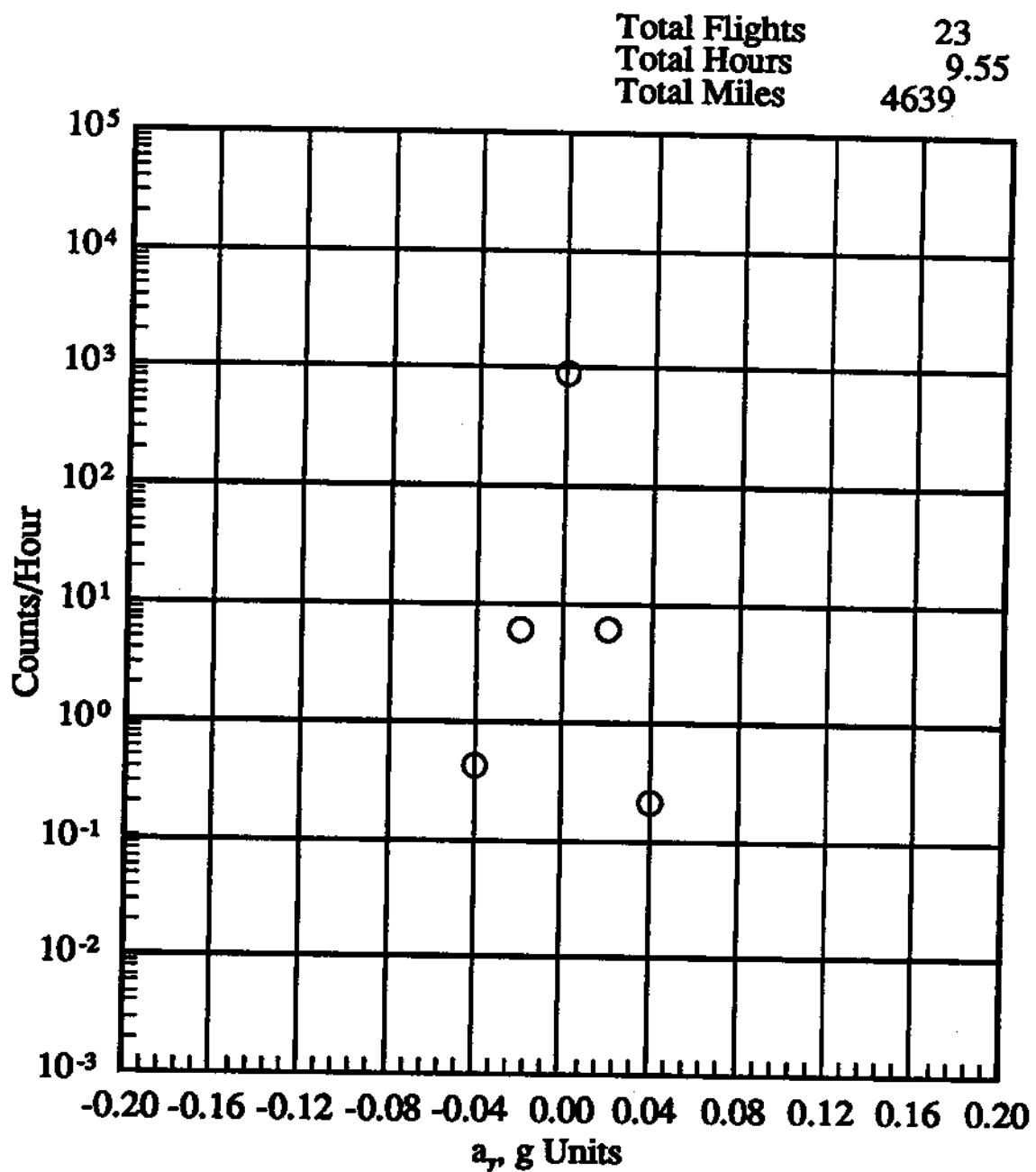
(e) 14500 to 19500 feet altitude

Figure 14.- Continued.



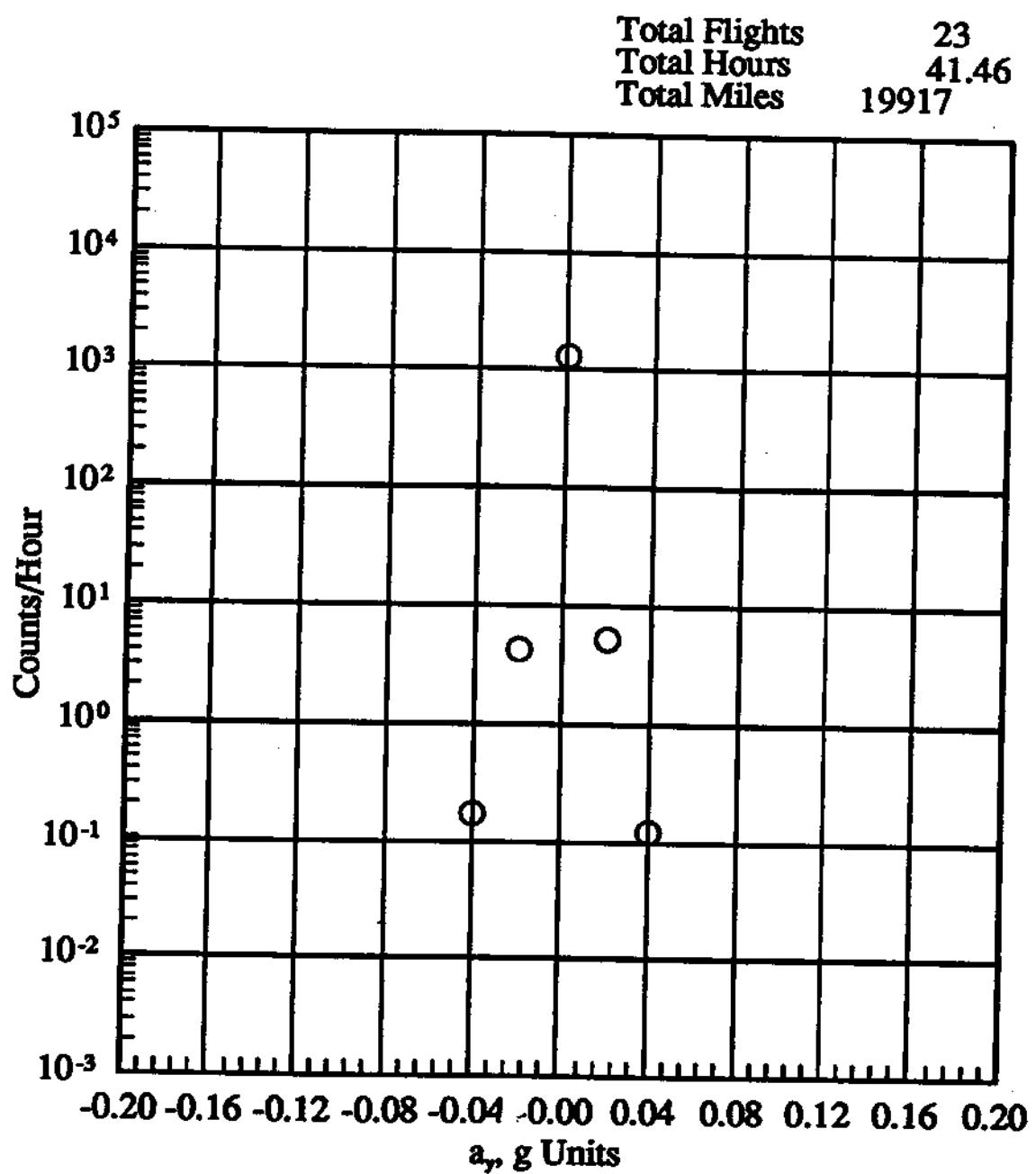
(f) 19500 to 24500 feet altitude

Figure 14.- Continued.



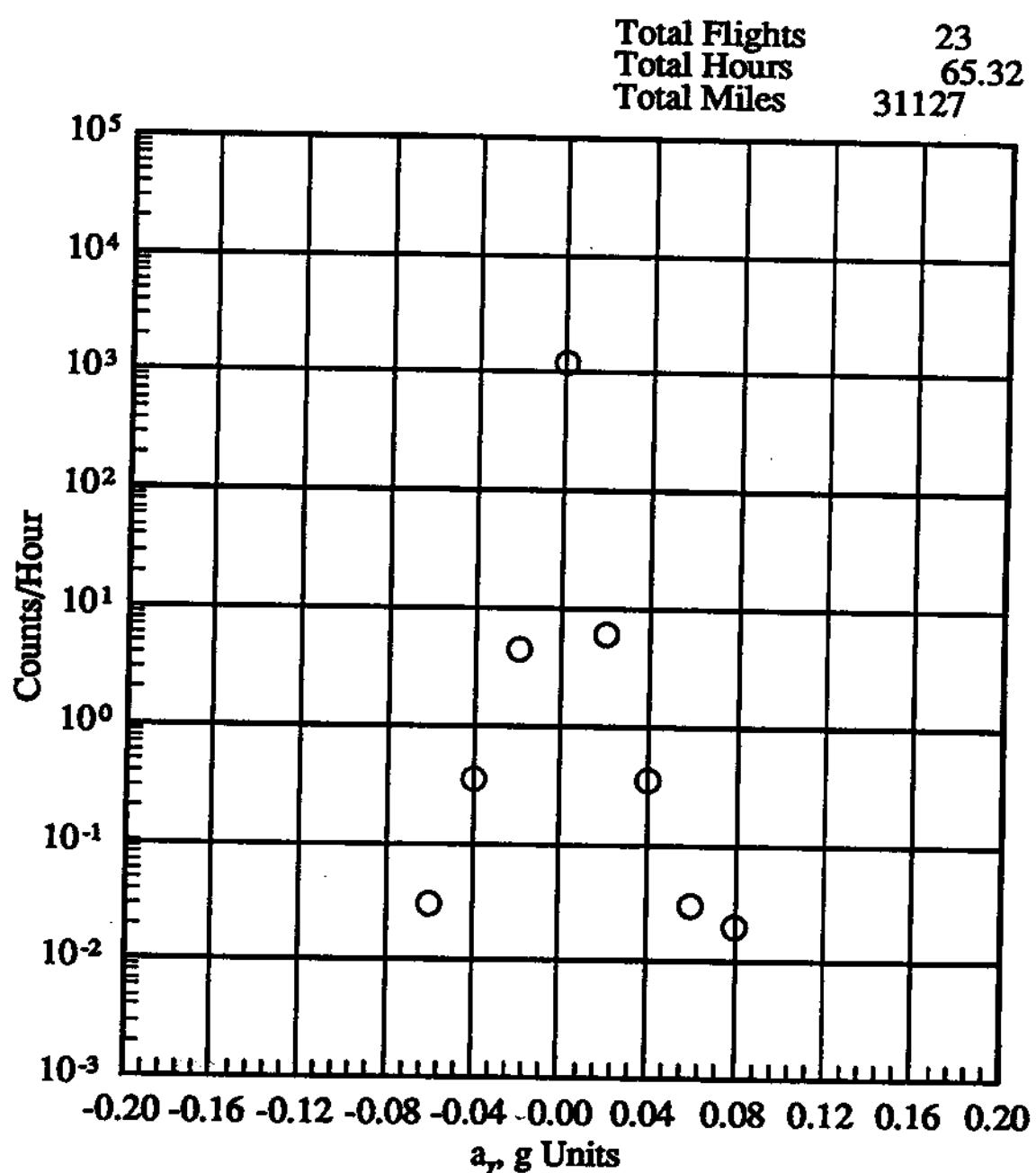
(g) 24500 to 29500 feet altitude

Figure 14.- Continued.



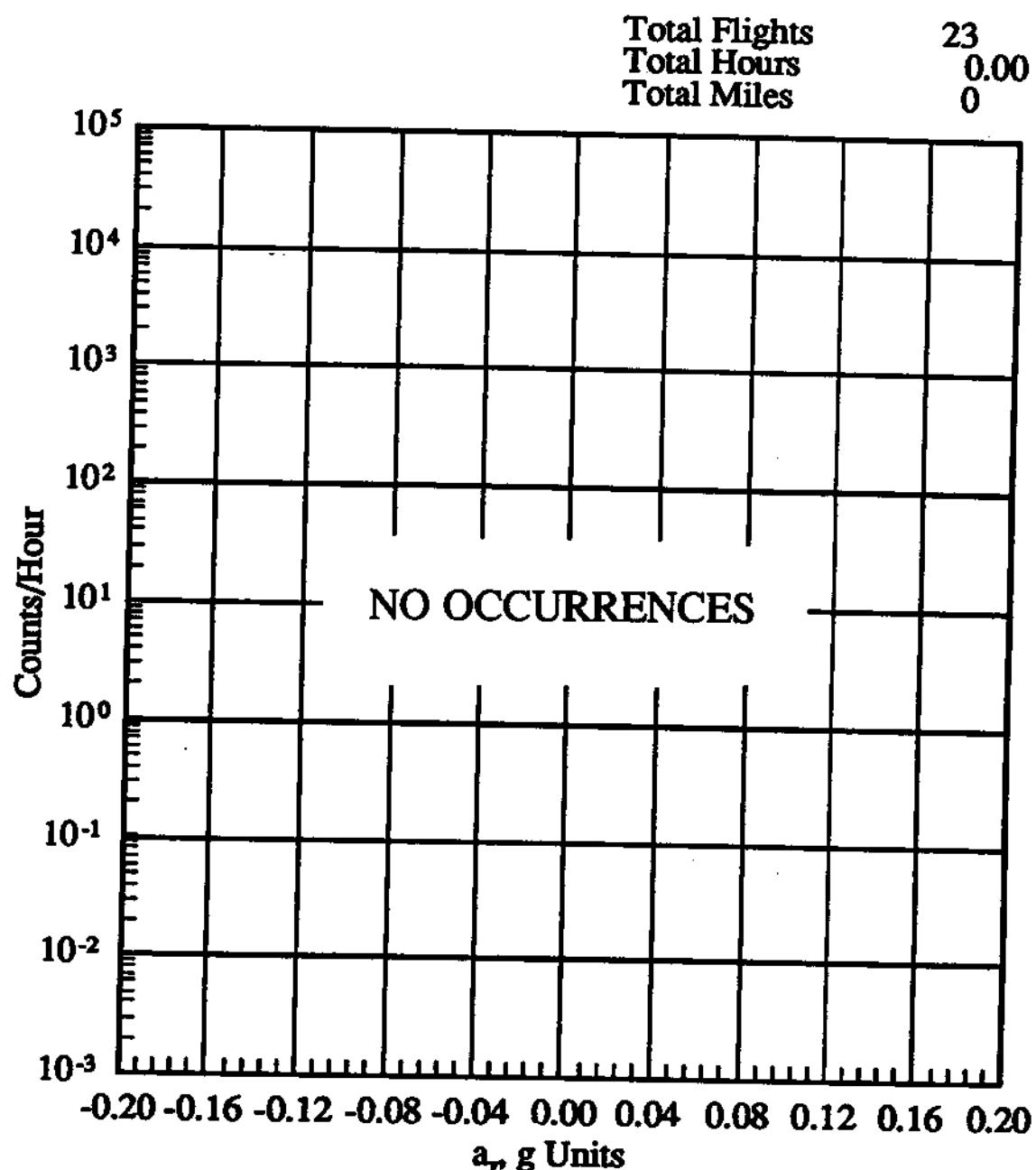
(h) 29500 to 34500 feet altitude

Figure 14.- Continued.



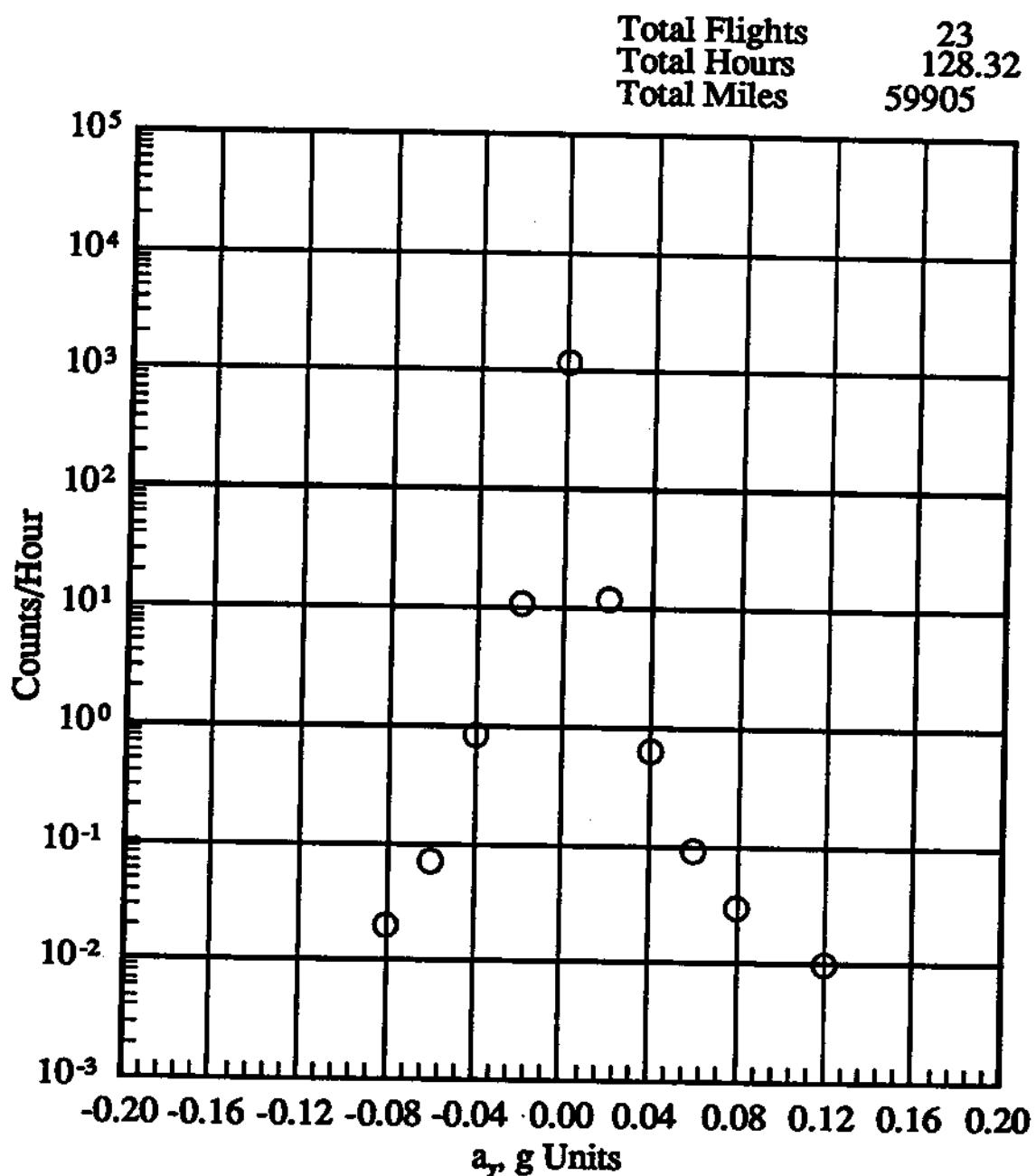
(i) 34500 to 39500 feet altitude

Figure 14.- Continued.



(j) 39500 to 44500 feet altitude

Figure 14.- Continued.



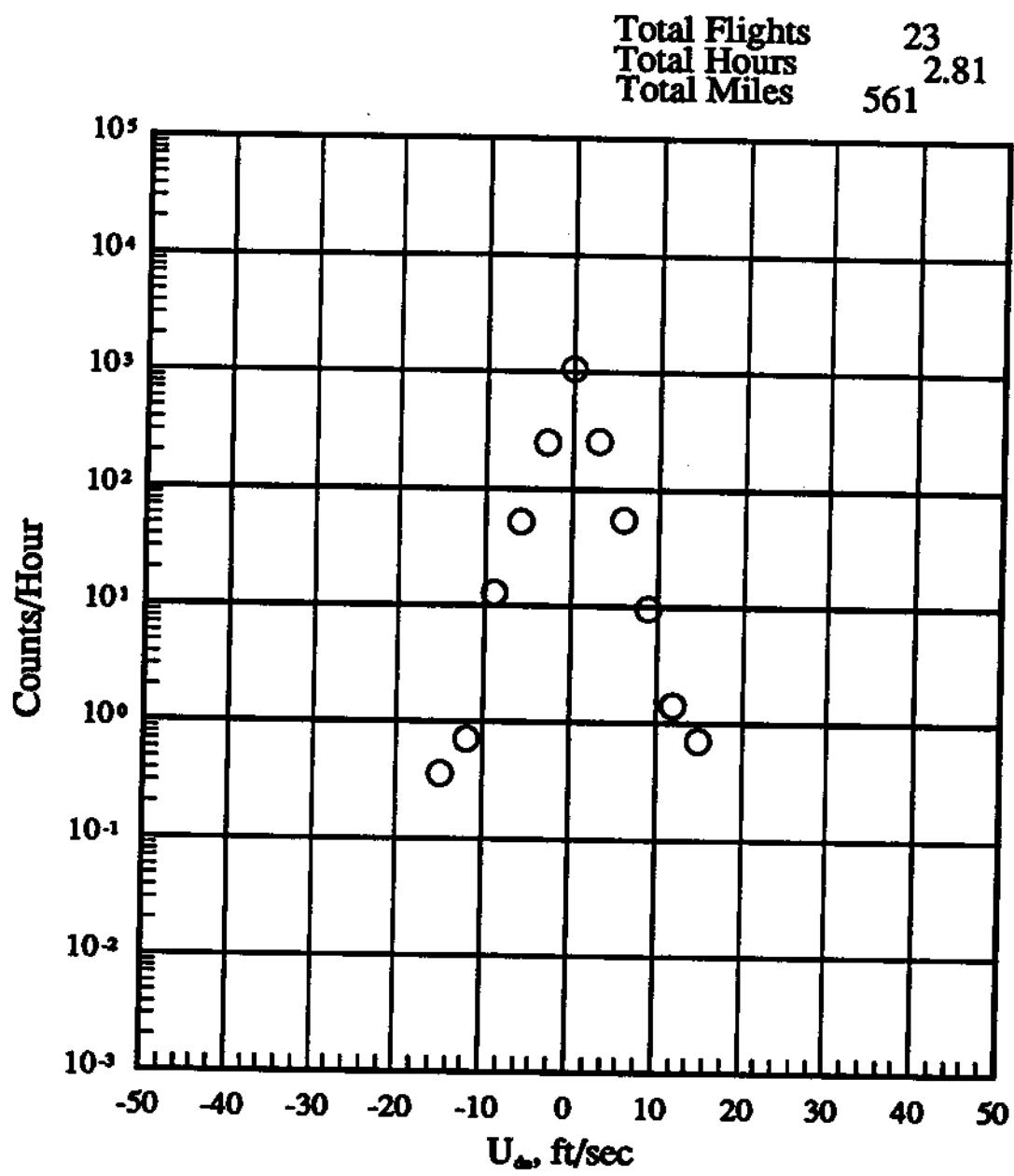
(k) -500 to 44500 feet altitude

Figure 14.- Concluded.

		PRESSURE ALTITUDE BANDS					
		9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT
$U_{de}$	DERIVED GUST VELOCITY LEVEL FT/SEC	TO 4500 FT					
		0	0	0	0	0	0
-500 TO 4500 FT	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
15	0.71	0.39	0	0	0	0	0
12	1.42	1.17	0	0	0	0	0
9	9.59	3.13	0	0.47	0	0	0.02
6	54.72	12.13	2.87	2.82	0.38	0.21	0.05
3	258.66	66.49	21.30	23.93	5.69	3.04	0.15
0	1061.64	1242.24	1902.64	1427.89	1486.70	1566.51	4.24
-3	250.49	65.32	21.71	24.87	6.45	3.25	2.72
-6	52.23	13.30	0.41	4.22	0.76	0.10	0.05
-9	12.79	4.30	0	0.47	0	0.10	0.02
-12	0.71	0.39	0	0	0	0	0.39
-15	0.36	0	0	0	0	0	0.02
-20	0	0	0	0	0	0	0.01
-30	0	0	0	0	0	0	0
-40	0	0	0	0	0	0	0
-50	0	0	0	0	0	0	0
-60	0	0	0	0	0	0	0
-70	0	0	0	0	0	0	0
-80	0	0	0	0	0	0	0
-90	0	0	0	0	0	0	0
-100	0	0	0	0	0	0	0
FLIGHT HOURS @ ALT	2.81	2.56	2.44	2.13	2.64	9.55	41.46
FLIGHT MILES @ ALT	561.49	714.53	878.79	879.79	1187.79	4639.71	19917.03
TOTAL FLIGHTS						31127.09	0
TOTAL FLIGHT HOURS FLAPS UP AND DOWN						65.32	126.92
TOTAL FLIGHT MILES FLAPS UP AND DOWN						59904.53	59904.53

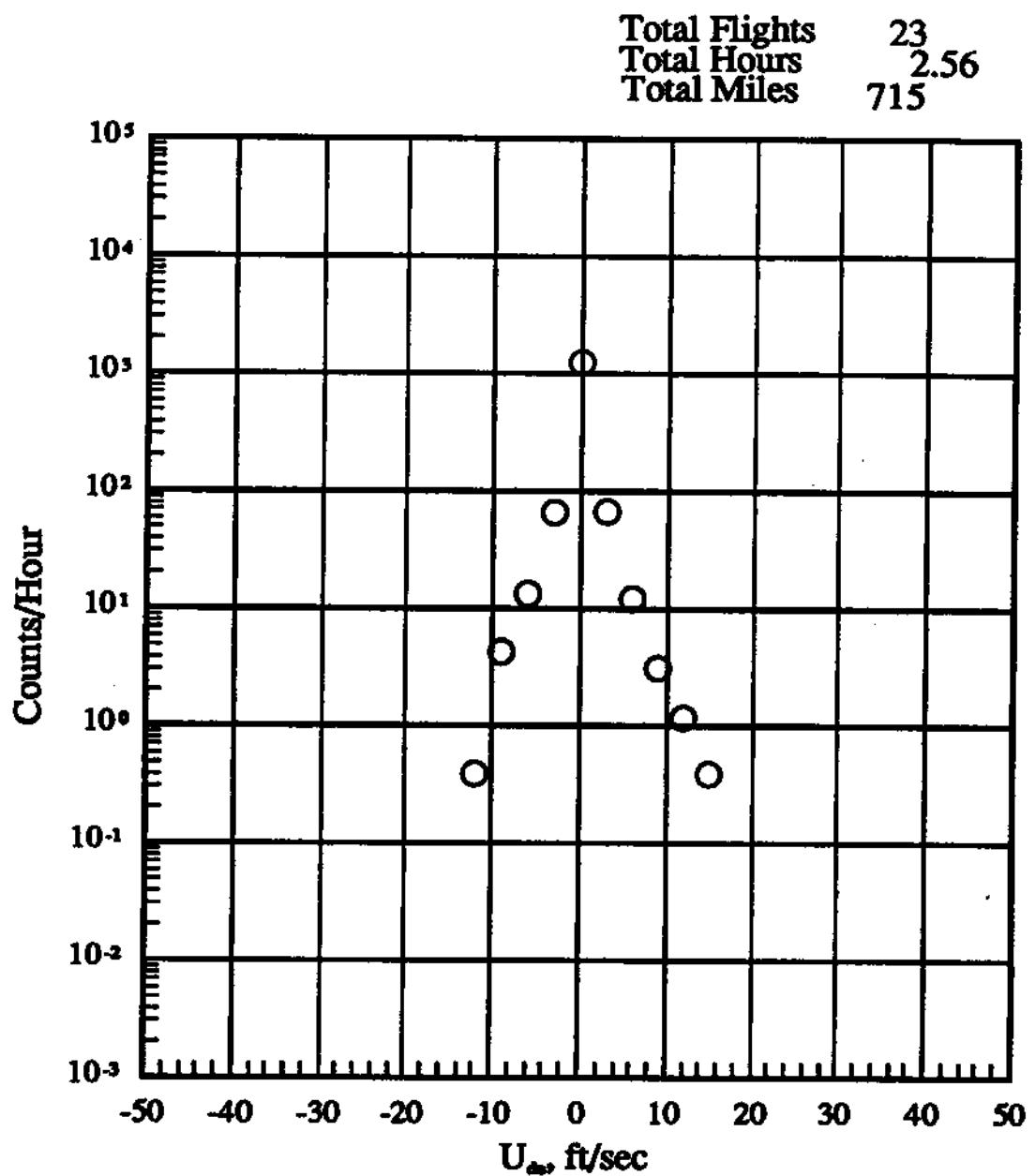
(a)  $U_{de}$  Level crossing counts per hour within pressure altitude bands

Figure 15.-  $U_{de}$  exceedances.



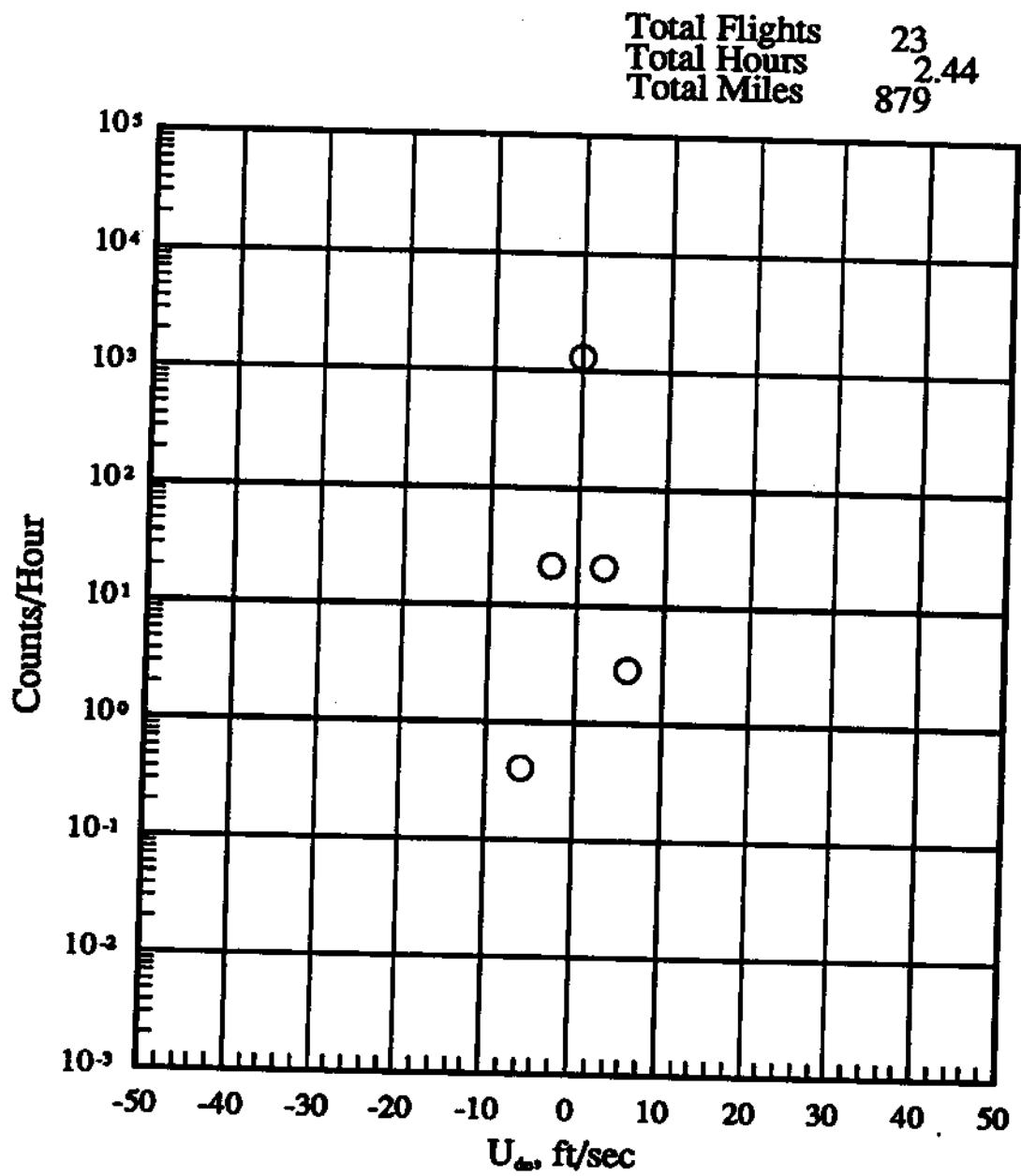
(b) -500 to 4500 feet altitude

Figure 15.- Continued.



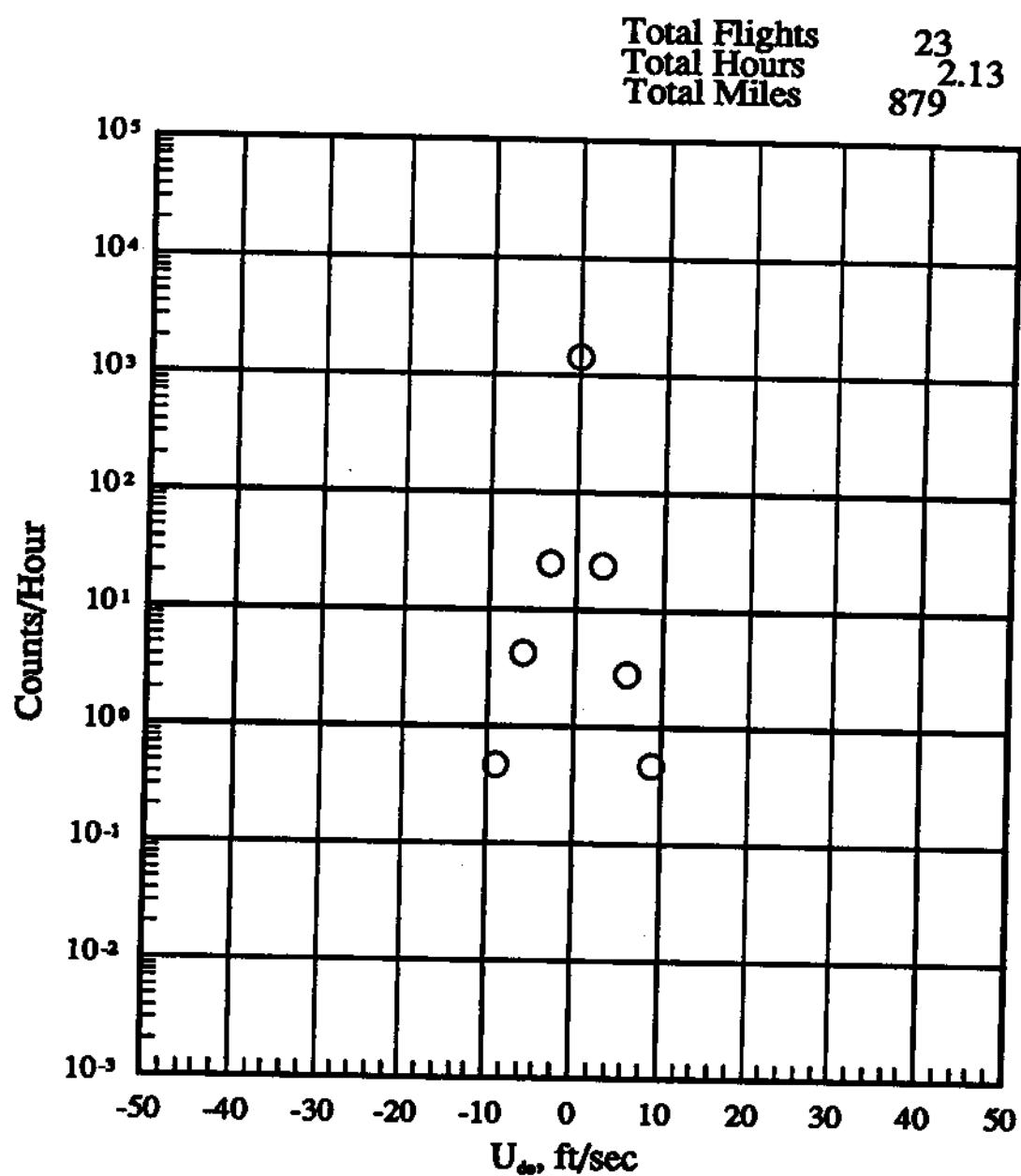
(c) 4500 to 9500 feet altitude

Figure 15.- Continued.



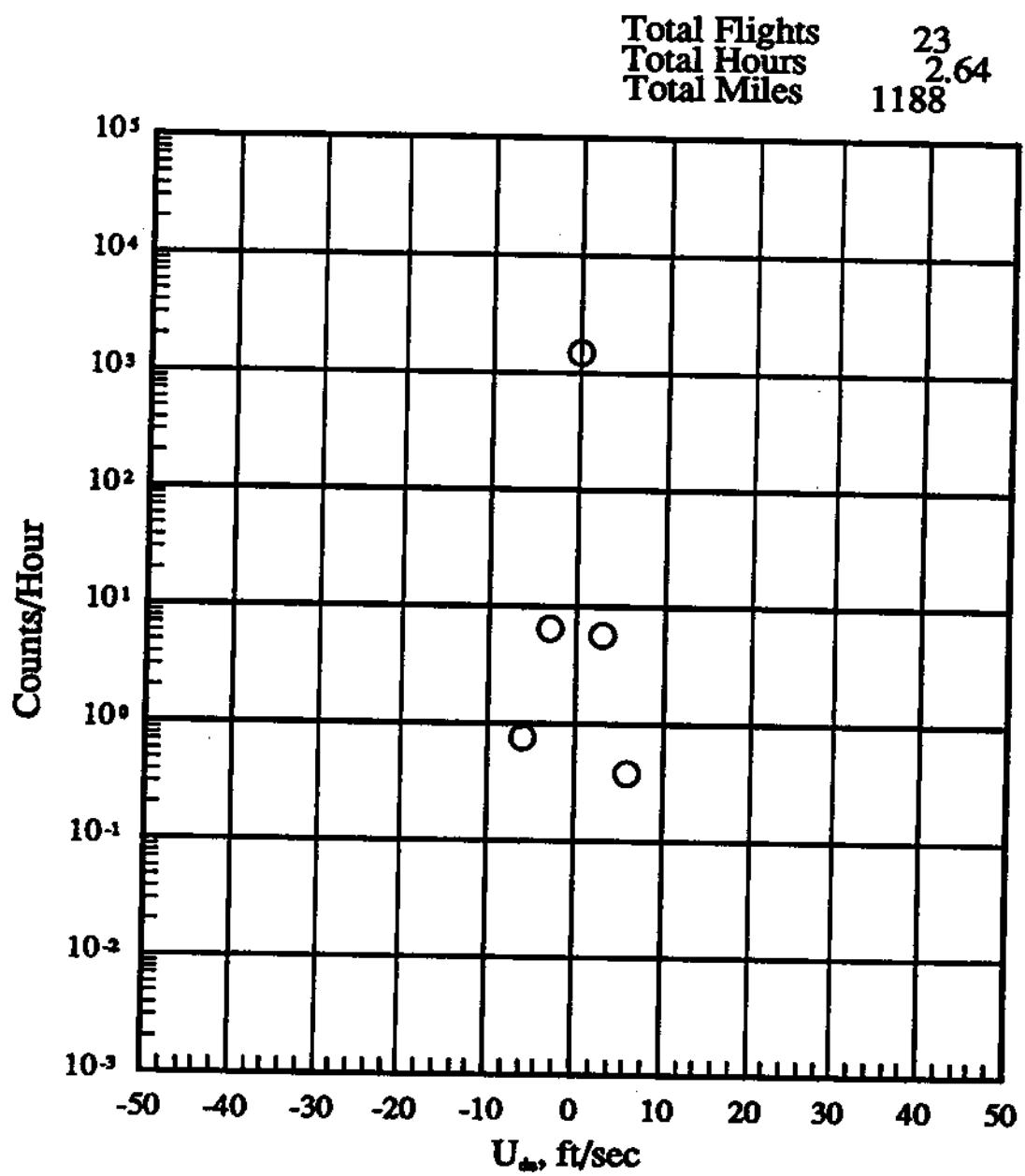
(d) 9500 to 14500 feet altitude

Figure 15.- Continued.



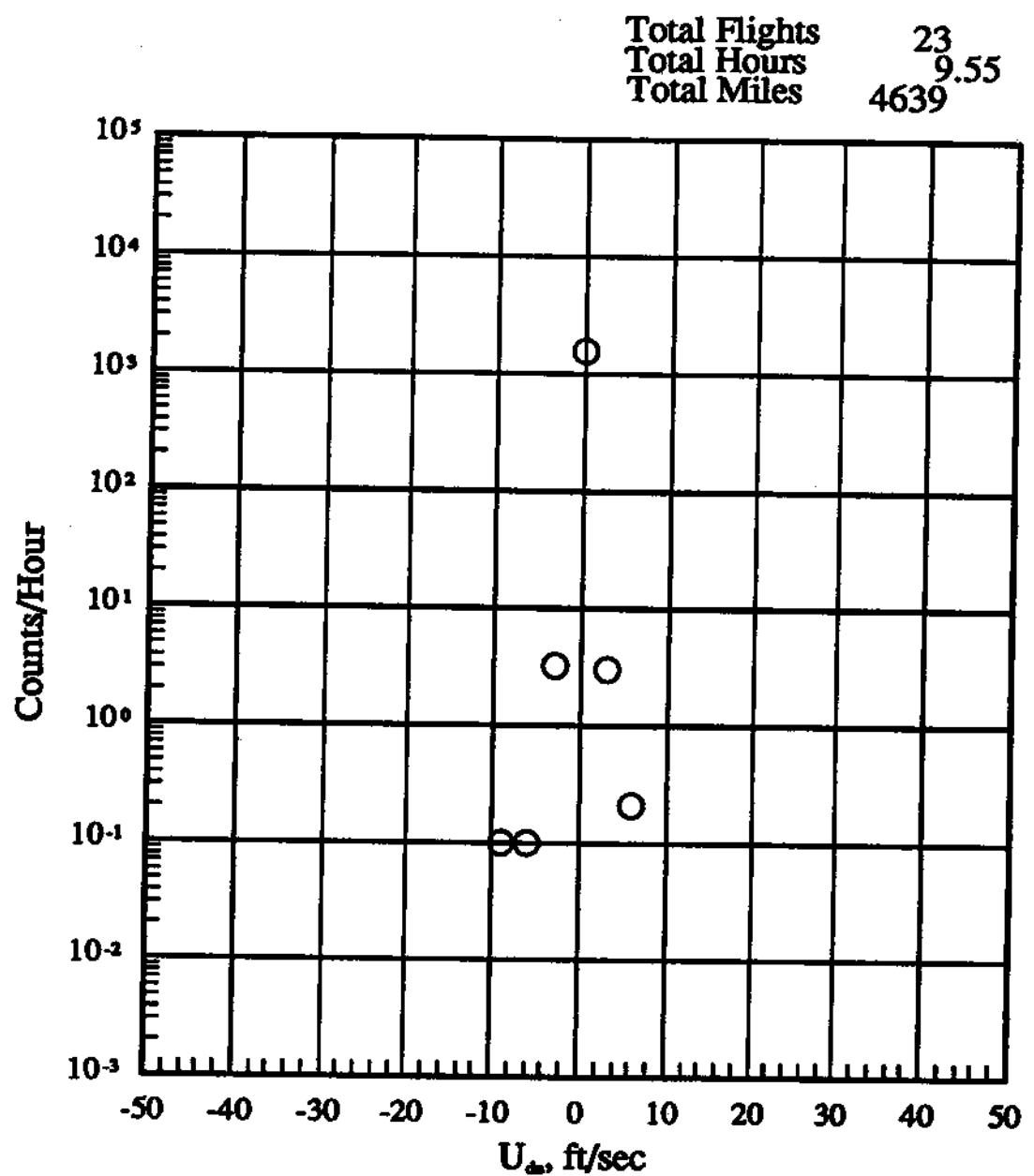
(e) 14500 to 19500 feet altitude

Figure 15.- Continued.



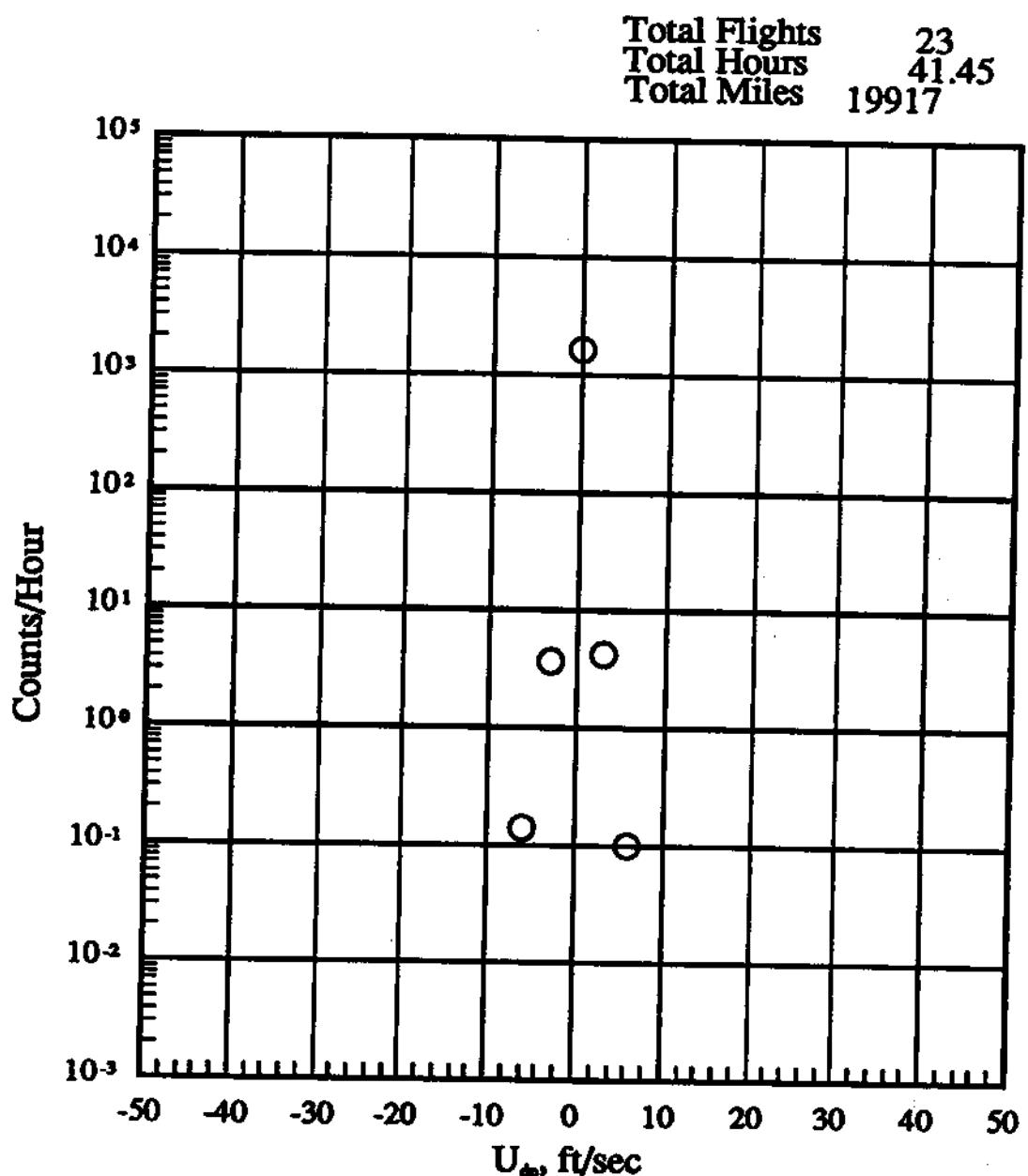
(f) 19500 to 24500 feet altitude

Figure 15.- Continued.



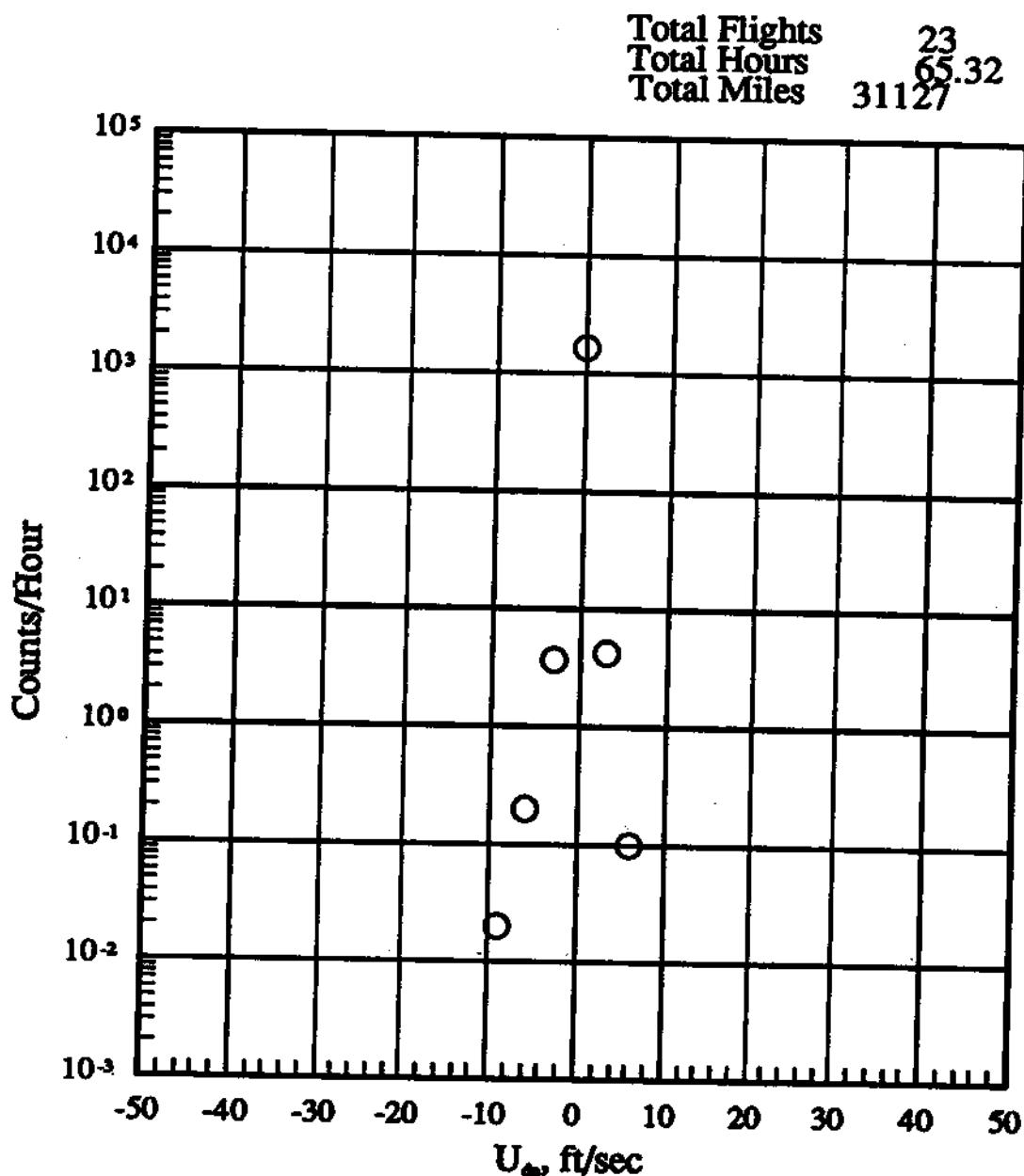
(g) 24500 to 29500 feet altitude

Figure 15.- Continued.



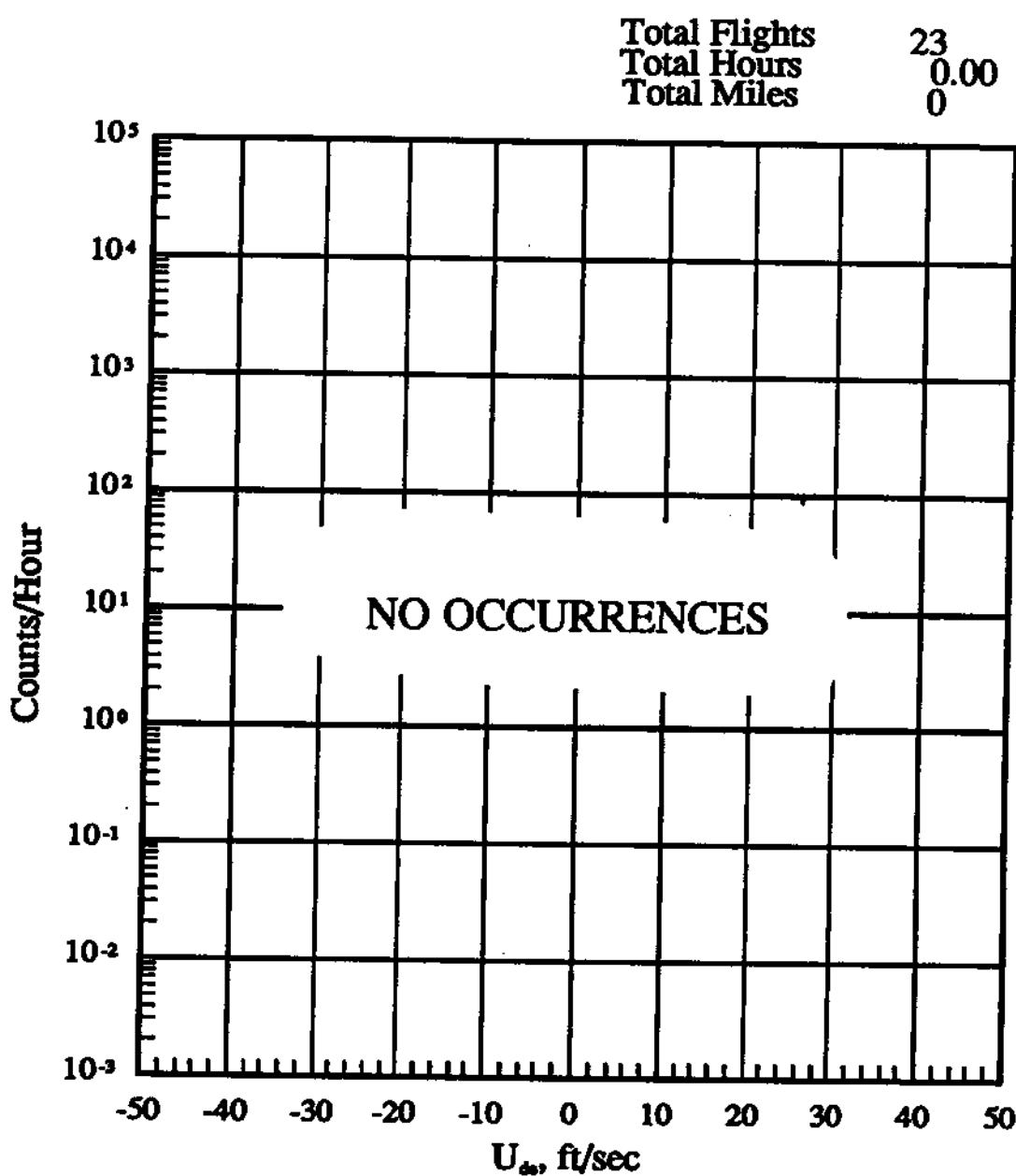
(h) 29500 to 34500 feet altitude

Figure 15.- Continued.



(i) 34500 to 39500 feet altitude

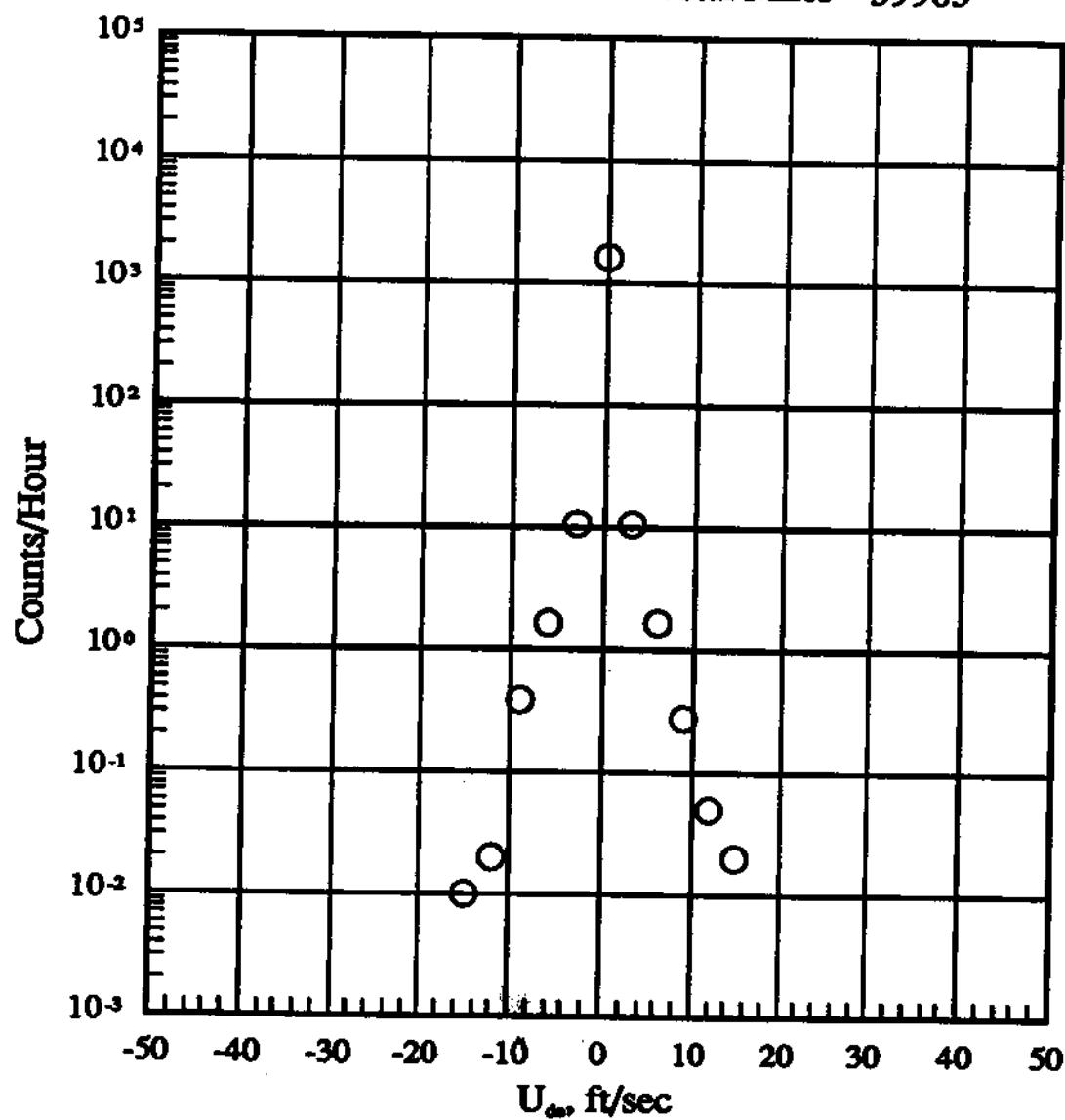
Figure 15.- Continued.



(j) 39500 to 44500 feet altitude

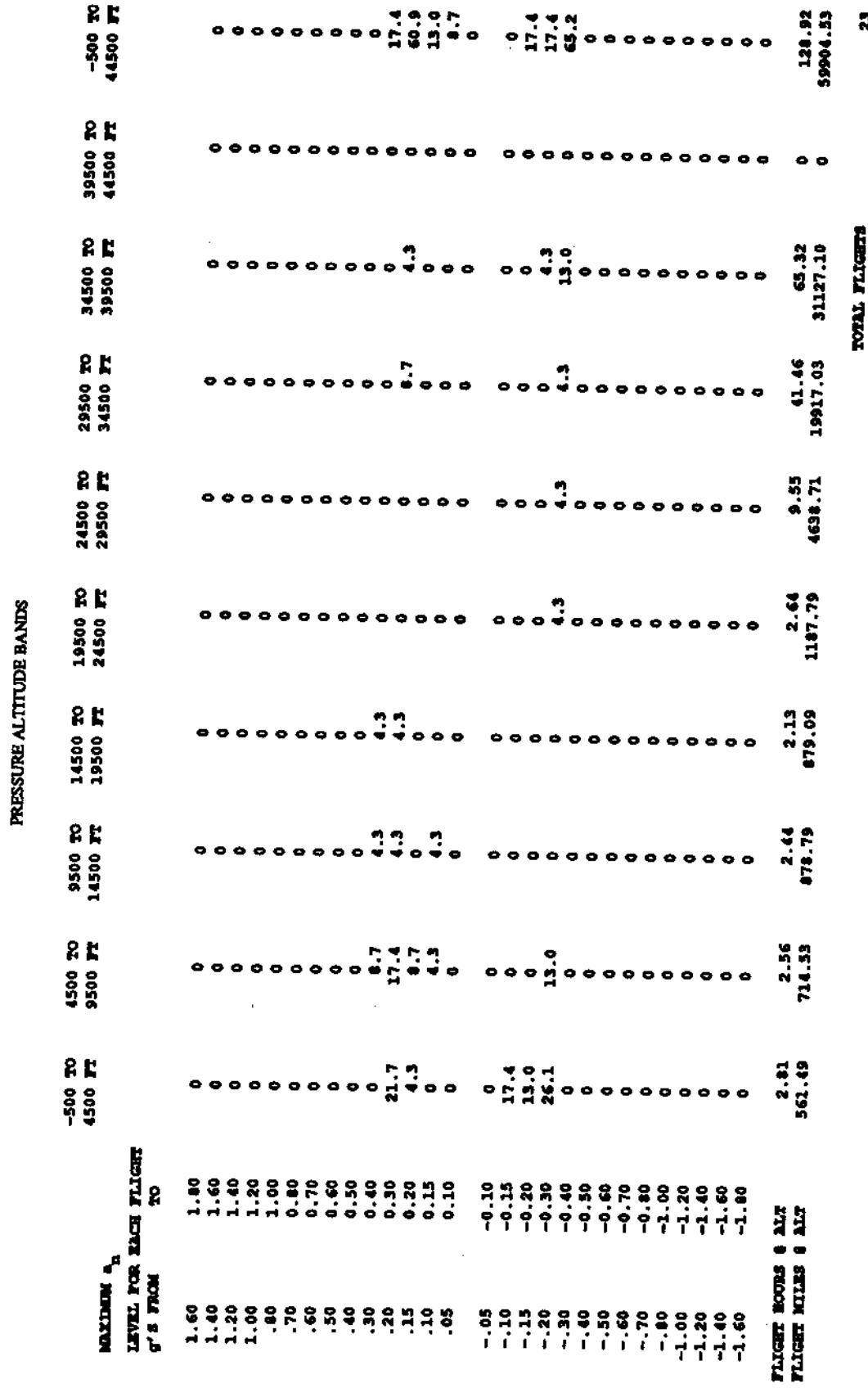
Figure 15.- Continued.

Total Flights 23  
Total Hours 128.82  
Total Miles 59905



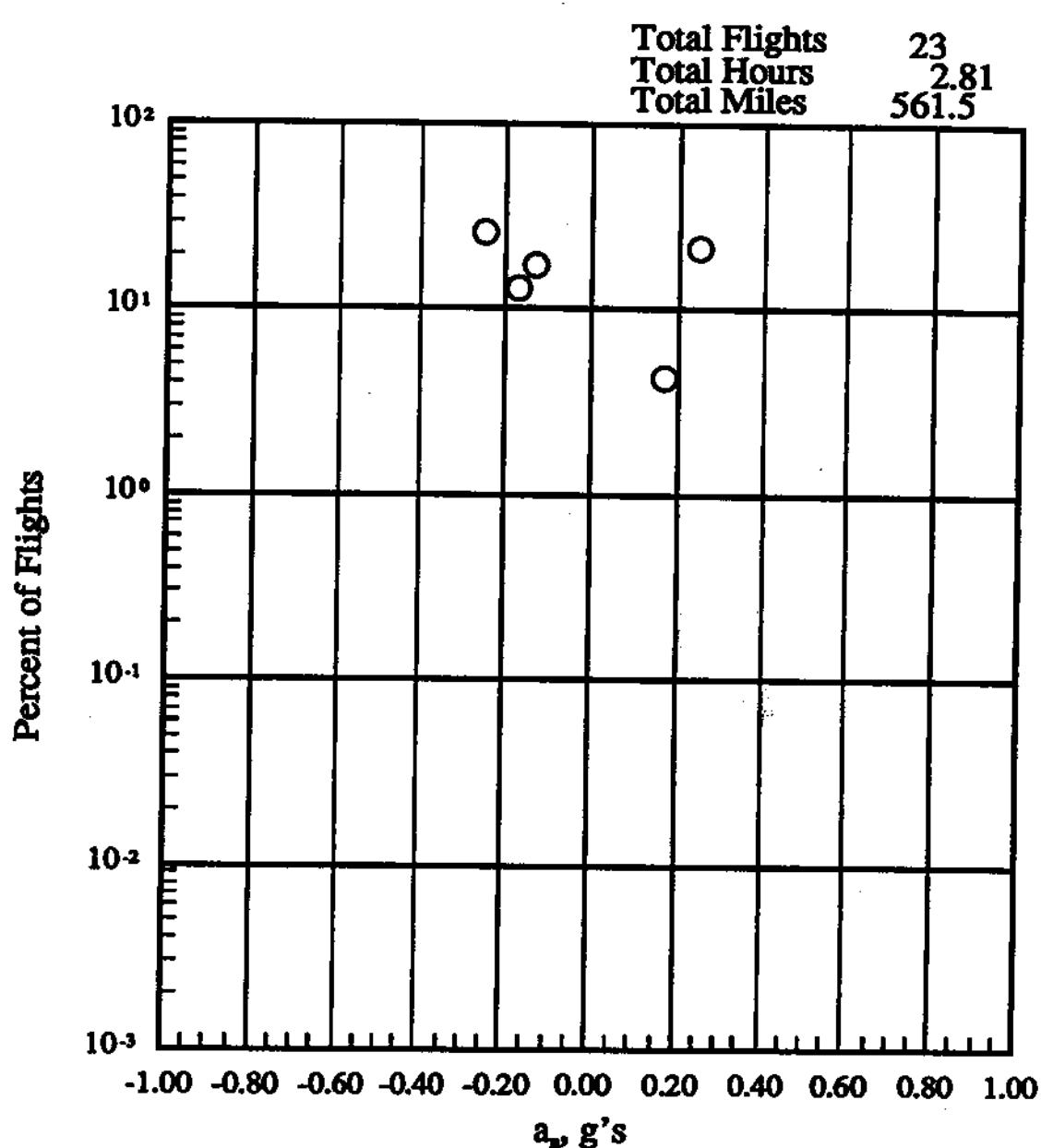
(k) -500 to 44500 feet altitude

Figure 15.- Concluded.



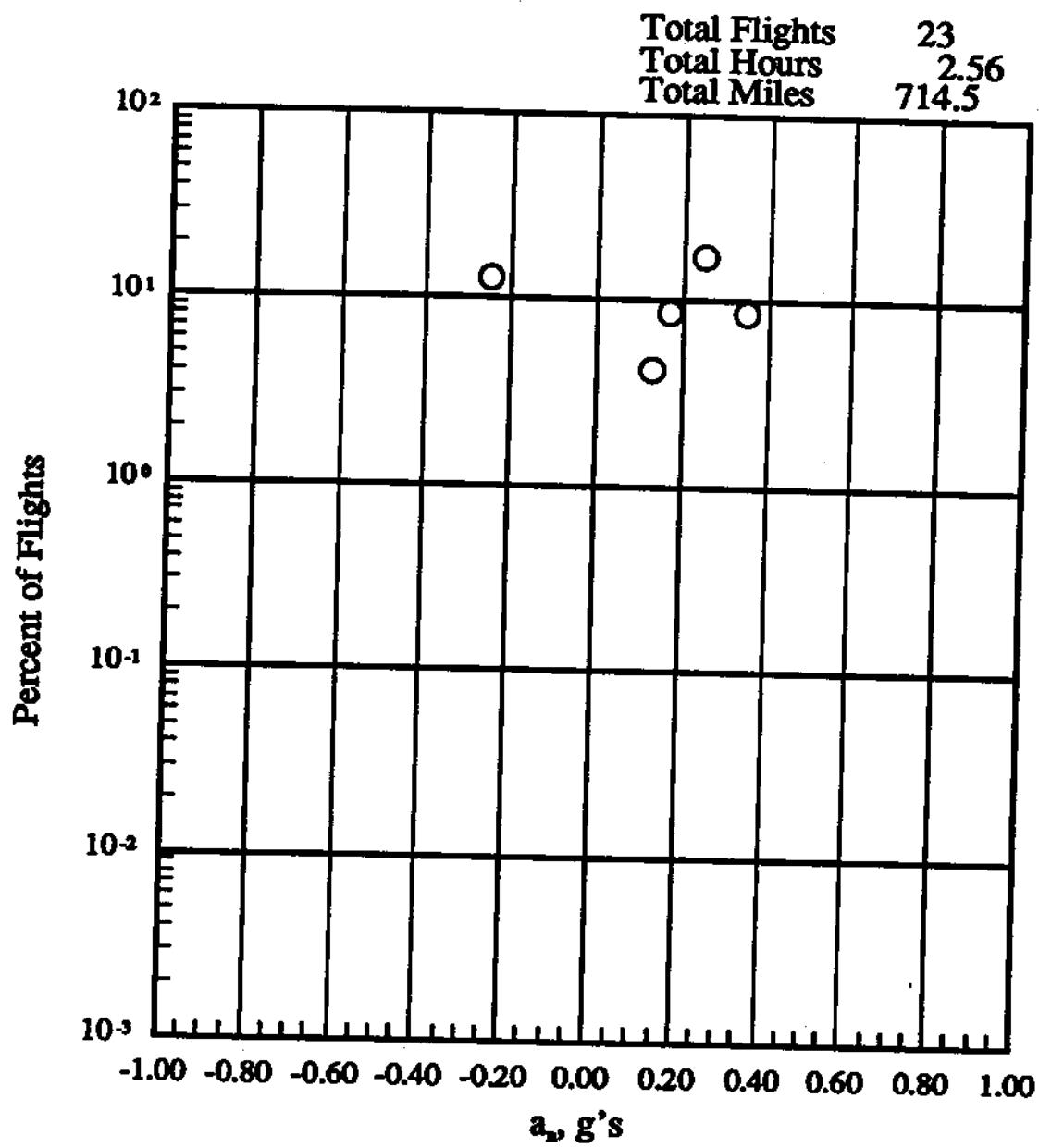
(a) Percent of flights where peak positive and negative  $a_n$  per flight occurs within pressure altitude bands, any flap

Figure 16.- Peak positive and negative  $a_n$  vs altitude.



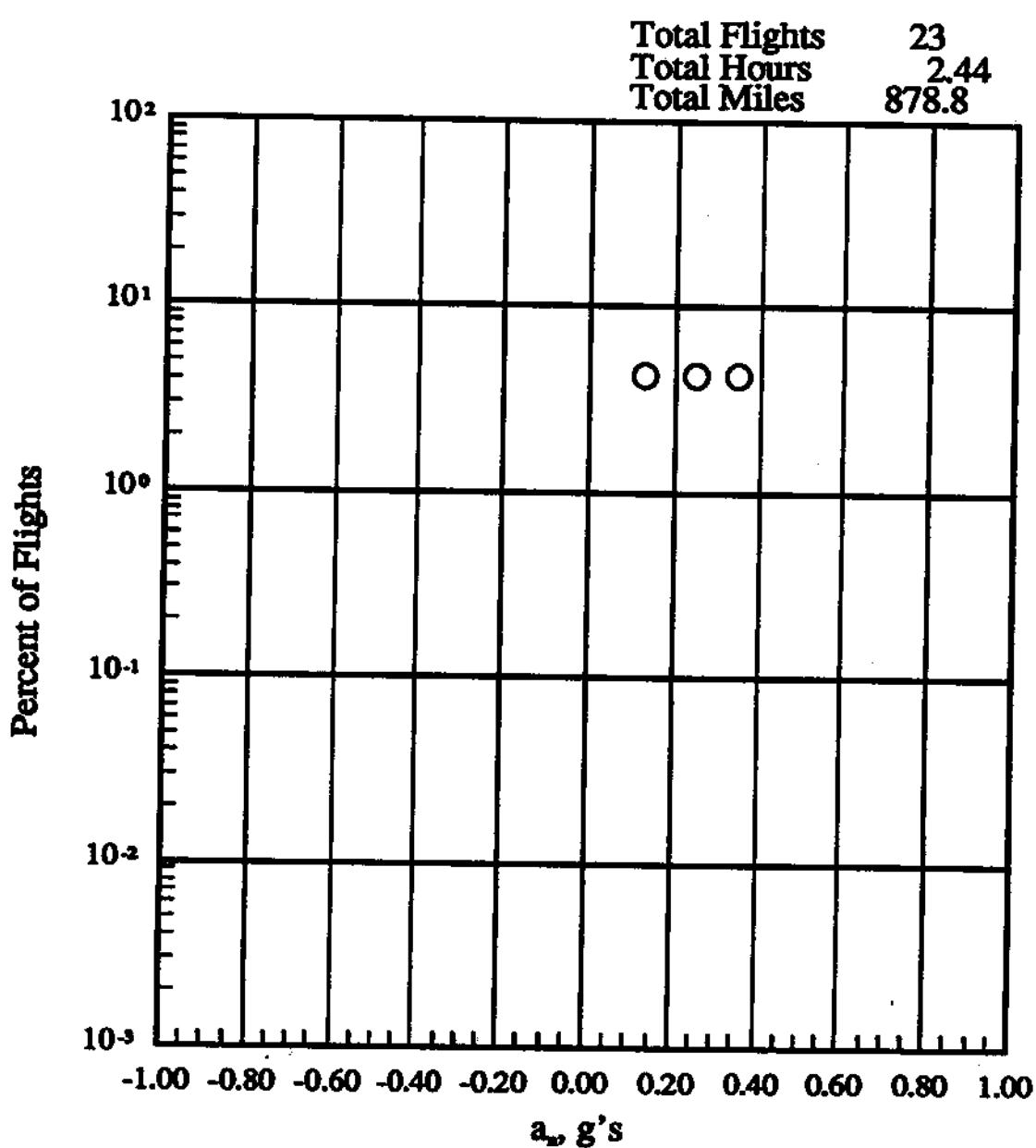
(b) -500 to 4500 feet altitude

Figure 16.- Continued.



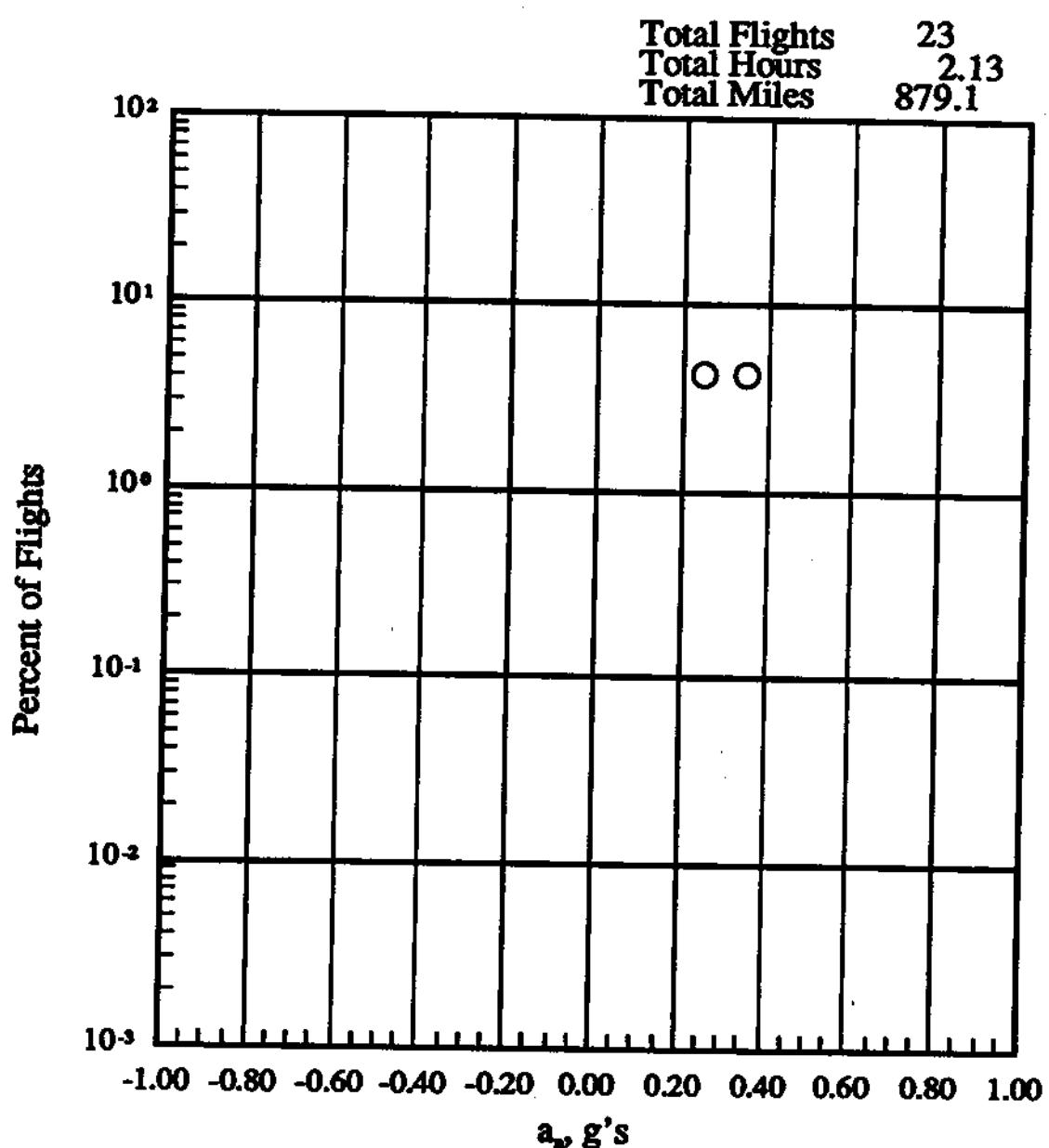
(c) 4500 to 9500 feet altitude

Figure 16.- Continued.



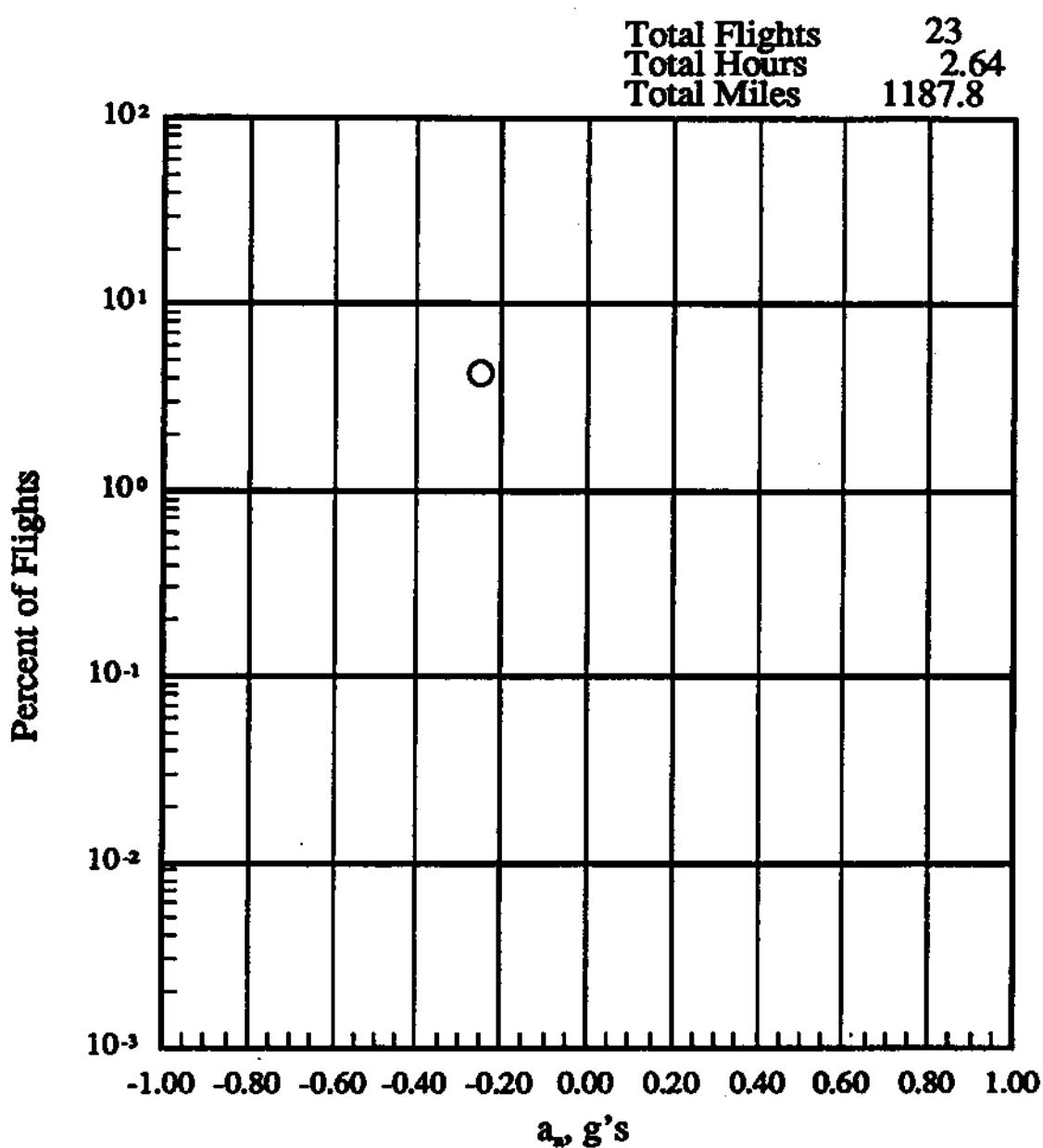
(d) 9500 to 14500 feet altitude

Figure 16.- Continued.



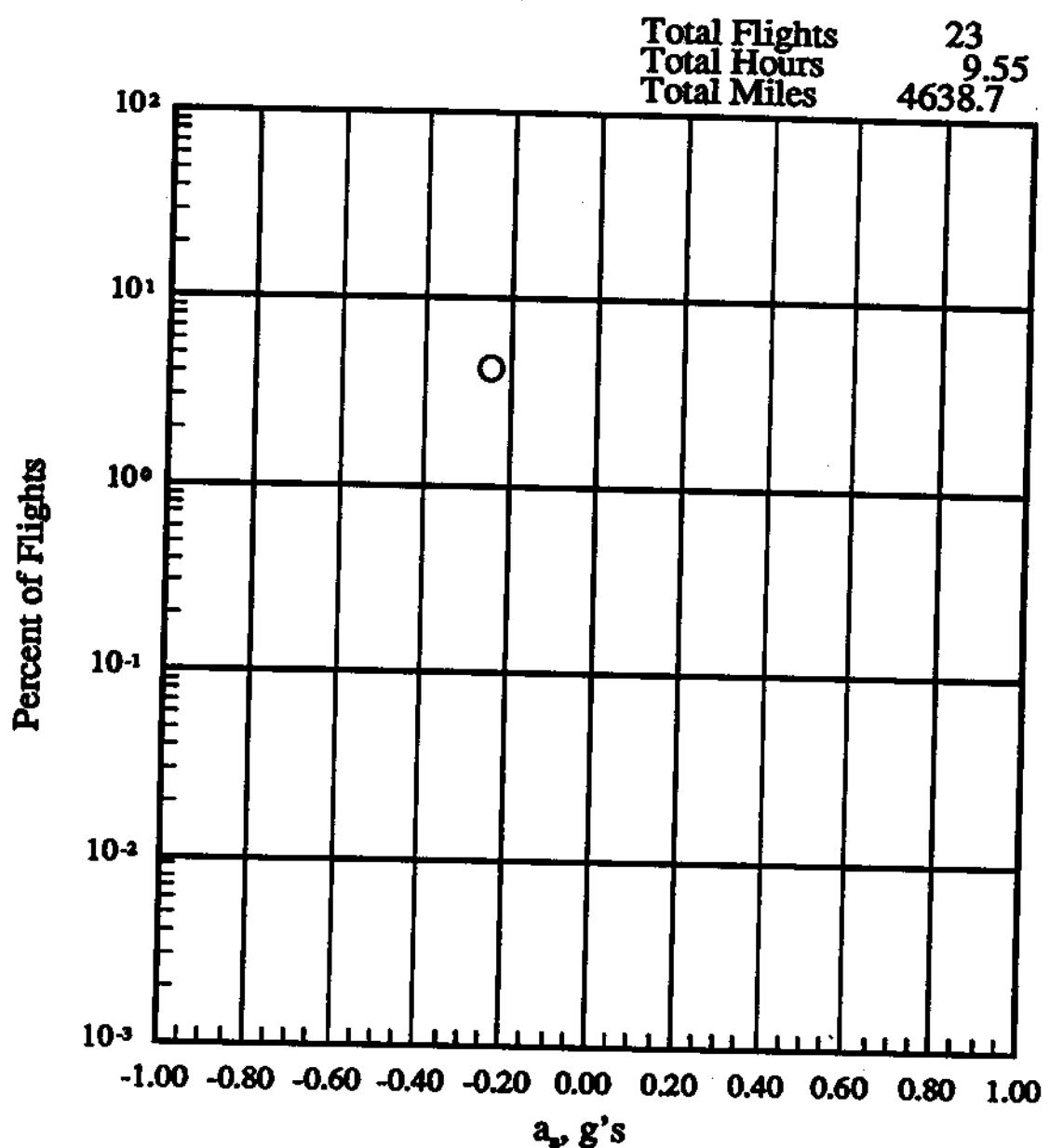
(e) 14500 to 19500 feet altitude

Figure 16.- Continued.



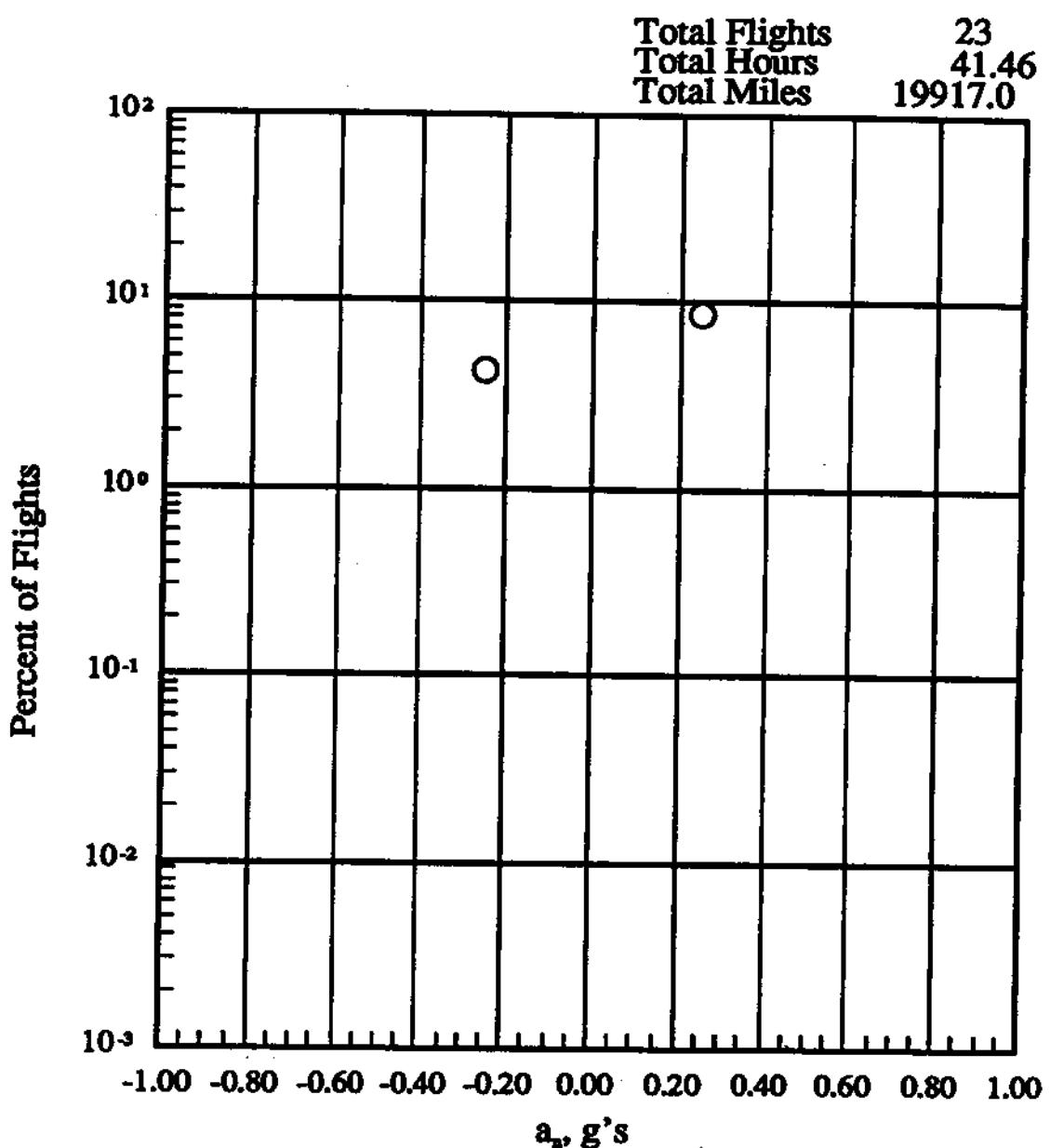
(f) 19500 to 24500 feet altitude

Figure 16.- Continued.



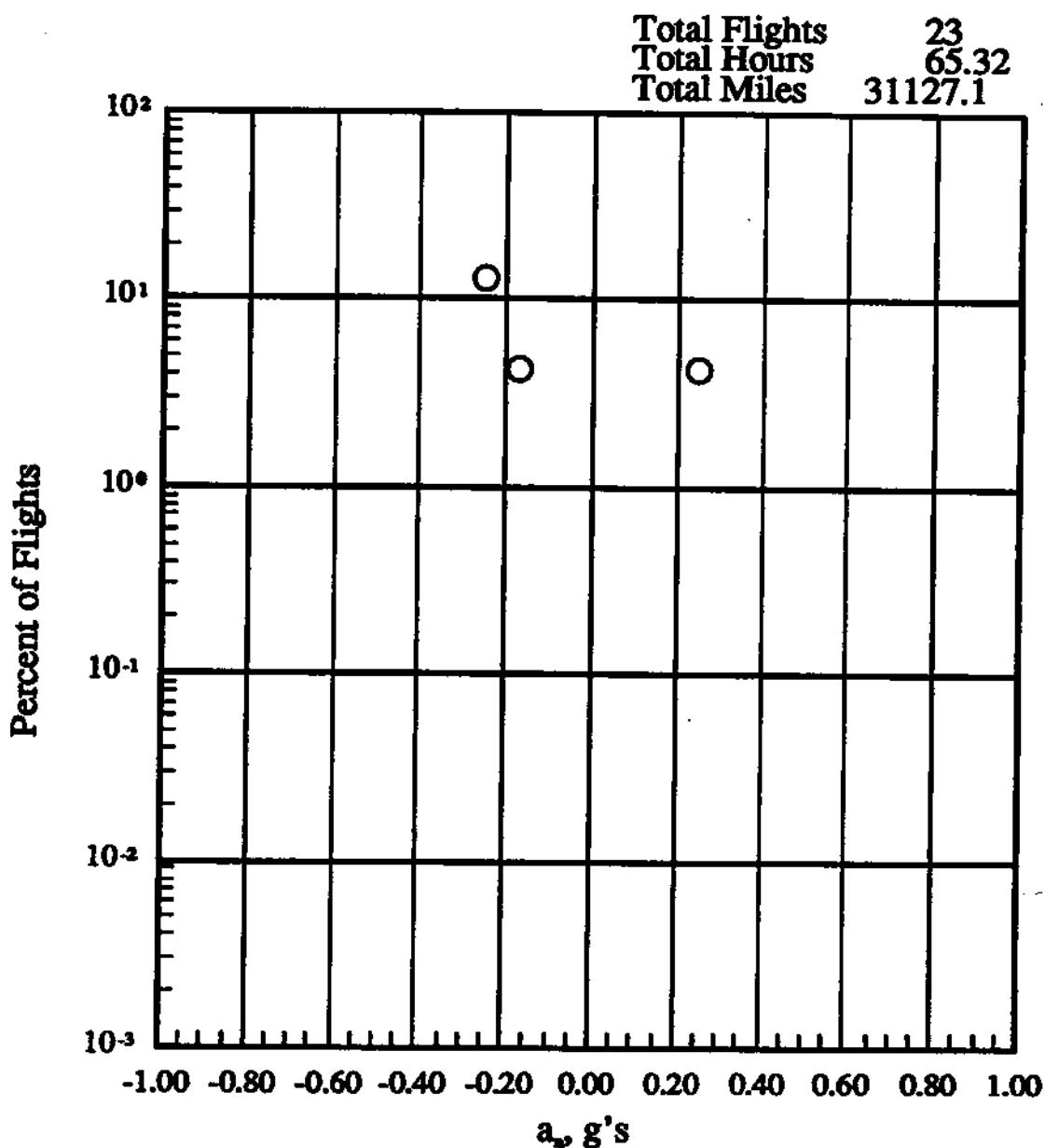
(g) 24500 to 29500 feet altitude

Figure 16.- Continued.



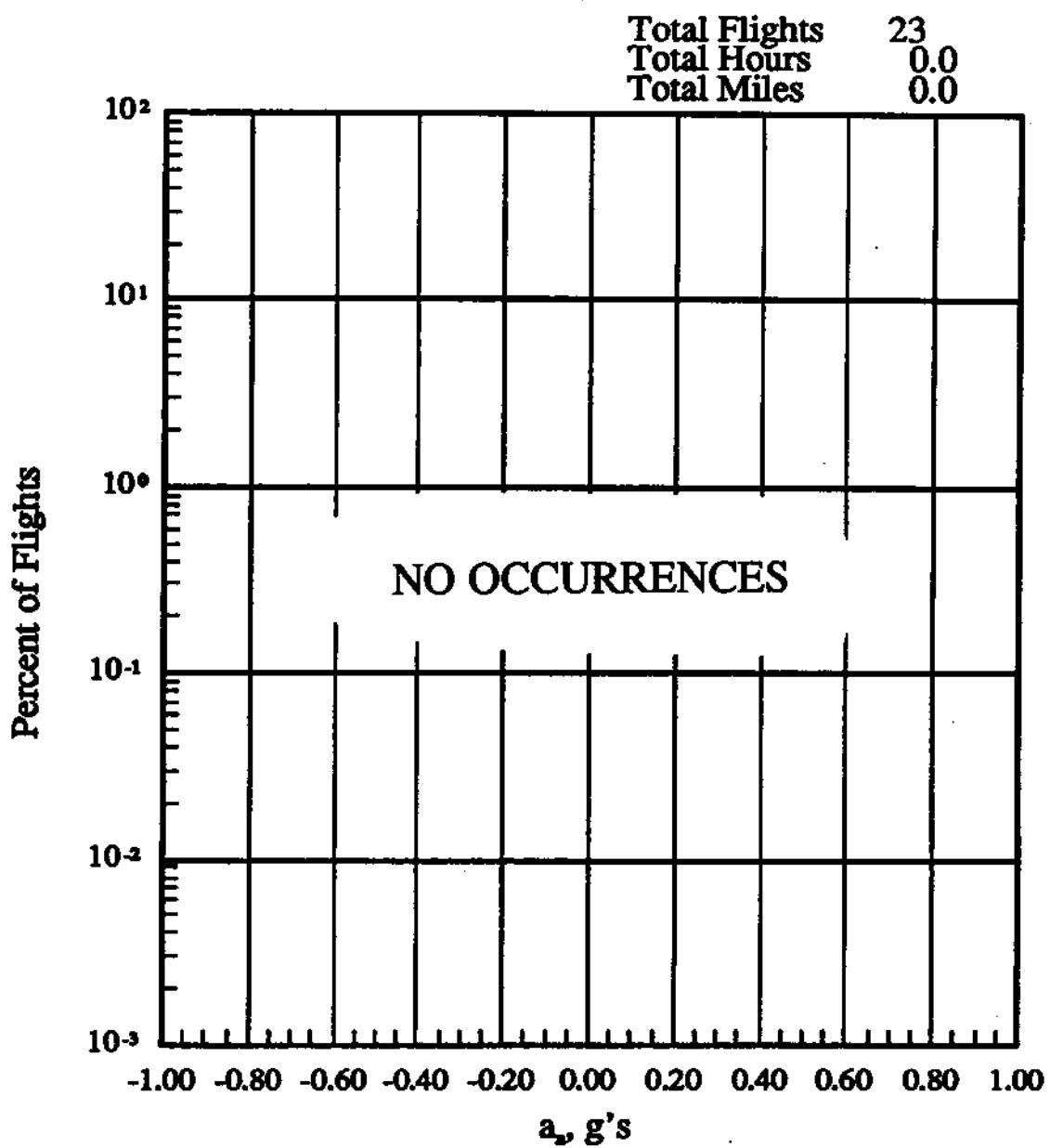
(h) 29500 to 34500 feet altitude

Figure 16.- Continued.



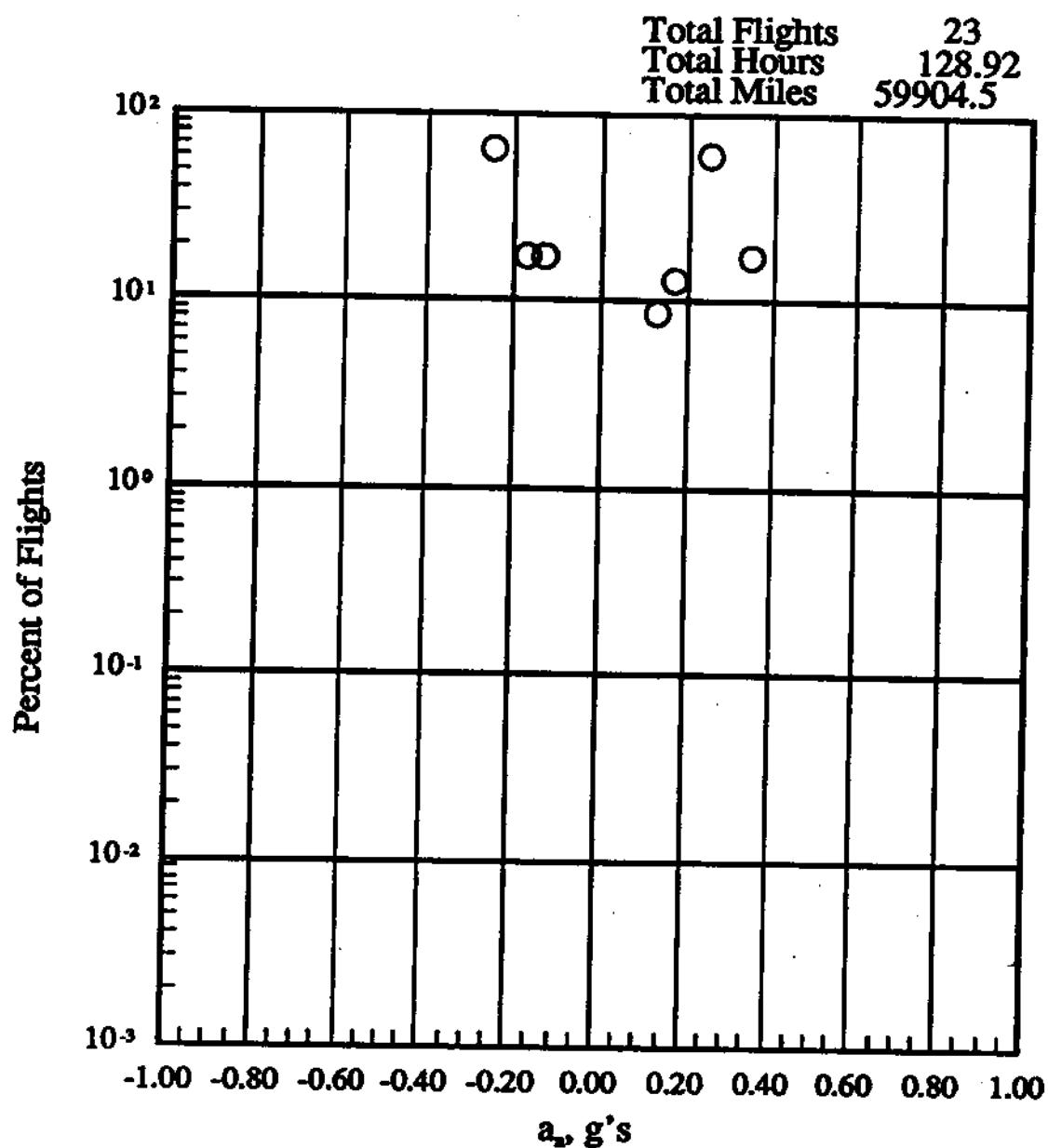
(i) 34500 to 39500 feet altitude

Figure 16.- Continued.



(j) 39500 to 44500 feet altitude

Figure 16.- Continued.



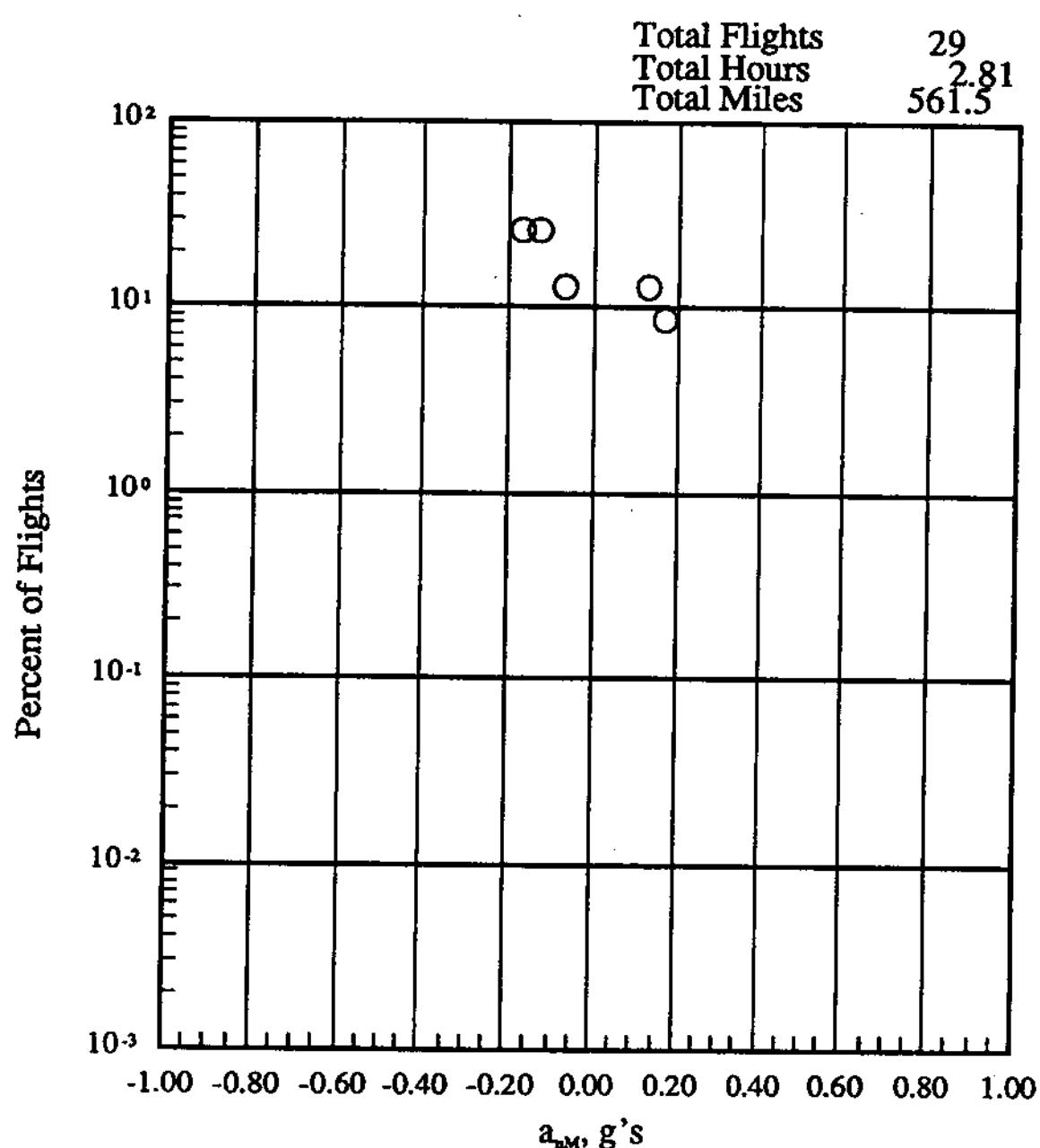
(k) -500 to 44500 feet altitude

Figure 16.- Concluded.

MAXIMUM $a_{nM}$	PRESSURE ALTITUDE BANDS										TOTAL FLIGHTS
	-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT	-500 TO 44500 FT	
1.60	1.90	0	0	0	0	0	0	0	0	0	0
1.40	1.60	0	0	0	0	0	0	0	0	0	0
1.20	1.40	0	0	0	0	0	0	0	0	0	0
1.00	1.20	0	0	0	0	0	0	0	0	0	0
.80	1.00	0	0	0	0	0	0	0	0	0	0
.70	0.80	0	0	0	0	0	0	0	0	0	0
.60	0.70	0	0	0	0	0	0	0	0	0	0
.50	0.60	0	0	0	0	0	0	0	0	0	0
.40	0.50	0	0	0	0	0	0	0	0	0	0
.30	0.40	0	0	0	0	0	0	0	0	0	0
.20	0.30	0	0	0	0	0	0	0	0	0	0
.15	0.20	0	0	0	0	0	0	0	0	0	0
.10	0.15	0	0	0	0	0	0	0	0	0	0
.05	0.10	0	0	0	0	0	0	0	0	0	0
-.05	-0.10	0	0	0	0	0	0	0	0	0	0
-.10	-0.15	0	0	0	0	0	0	0	0	0	0
-.15	-0.20	0	0	0	0	0	0	0	0	0	0
-.20	-0.30	0	0	0	0	0	0	0	0	0	0
-.30	-0.40	0	0	0	0	0	0	0	0	0	0
-.40	-0.50	0	0	0	0	0	0	0	0	0	0
-.50	-0.60	0	0	0	0	0	0	0	0	0	0
-.60	-0.70	0	0	0	0	0	0	0	0	0	0
-.70	-0.80	0	0	0	0	0	0	0	0	0	0
-.80	-1.00	0	0	0	0	0	0	0	0	0	0
-.90	-1.20	0	0	0	0	0	0	0	0	0	0
-1.00	-1.40	0	0	0	0	0	0	0	0	0	0
-1.20	-1.60	0	0	0	0	0	0	0	0	0	0
-1.40	-1.80	0	0	0	0	0	0	0	0	0	0
-1.60	-1.90	0	0	0	0	0	0	0	0	0	0
FLIGHT SECONDS @ ALT	2.81	2.56	2.44	2.13	2.64	9.55	41.46	65.32	0	125.92	
FLIGHT MINUTES @ ALT	561.49	714.53	878.79	879.09	1187.79	4638.71	19917.03	31127.10	0	59904.53	
									TOTAL FLIGHTS	23	

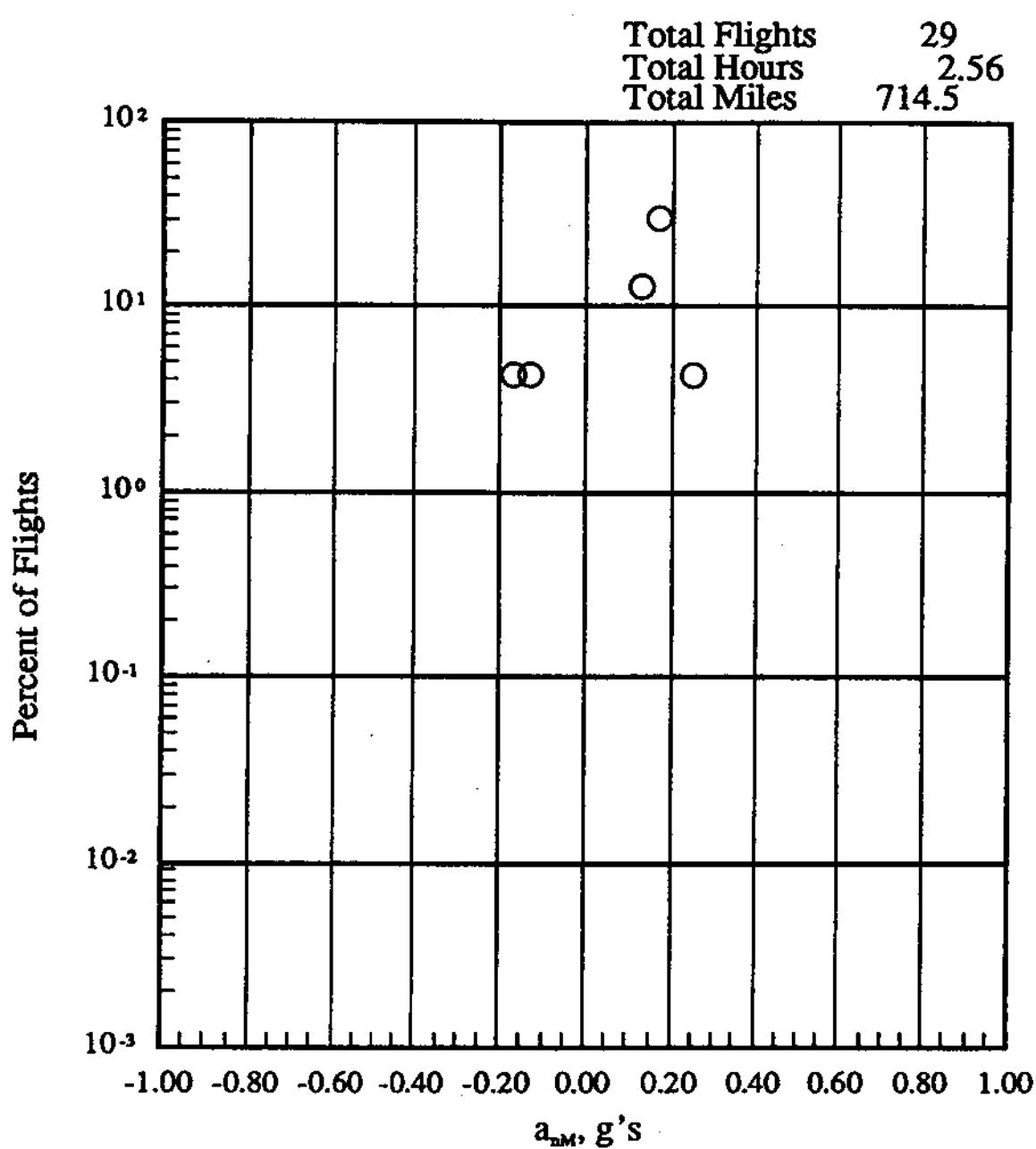
(a) Percent of flights where peak positive and negative  $a_{nM}$  per flight occurs within pressure altitude bands, any flap

Figure 17.- Peak positive and negative  $a_{nM}$  vs altitude.



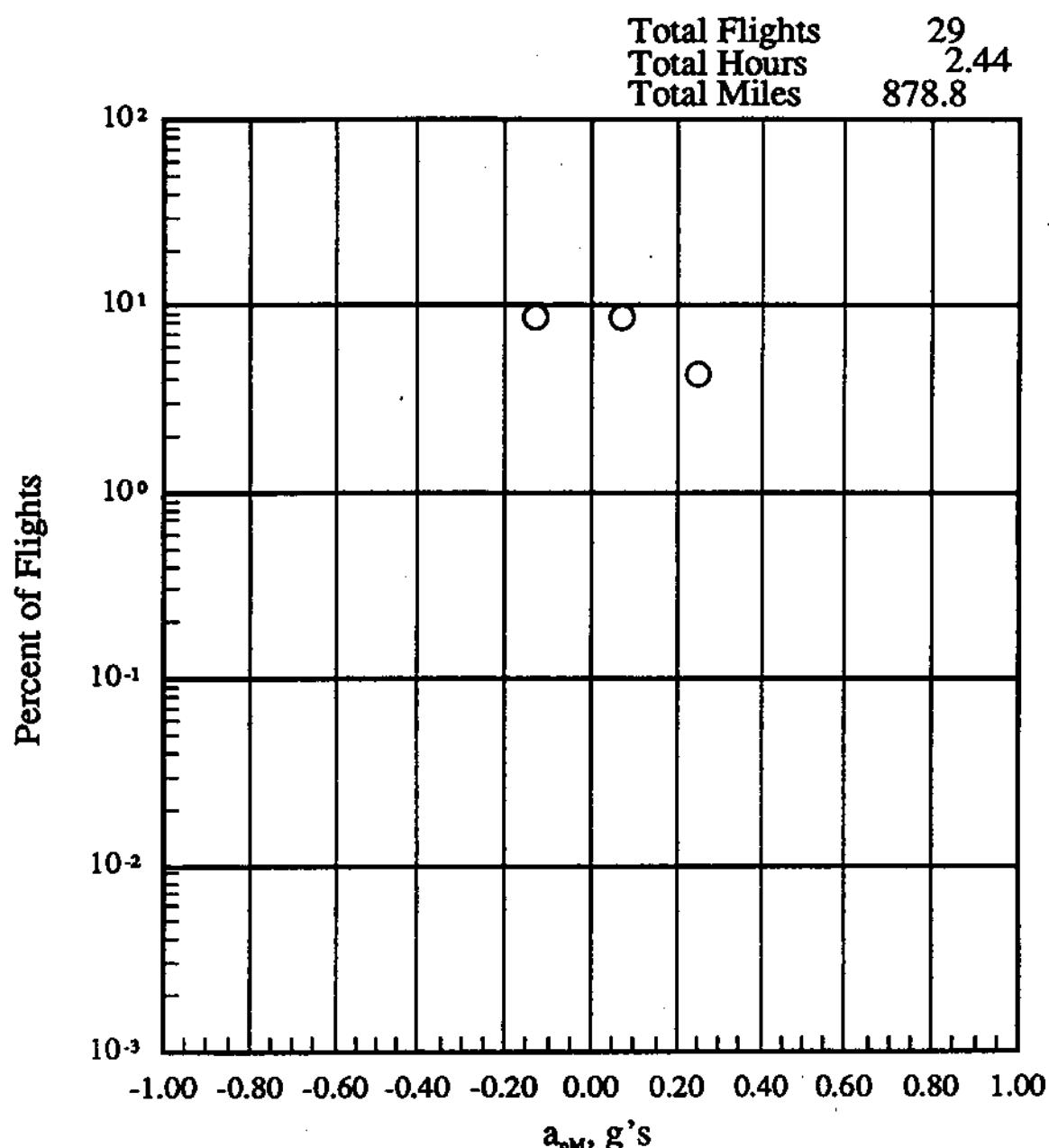
(b) -500 to 4500 feet altitude

Figure 17.- Continued.



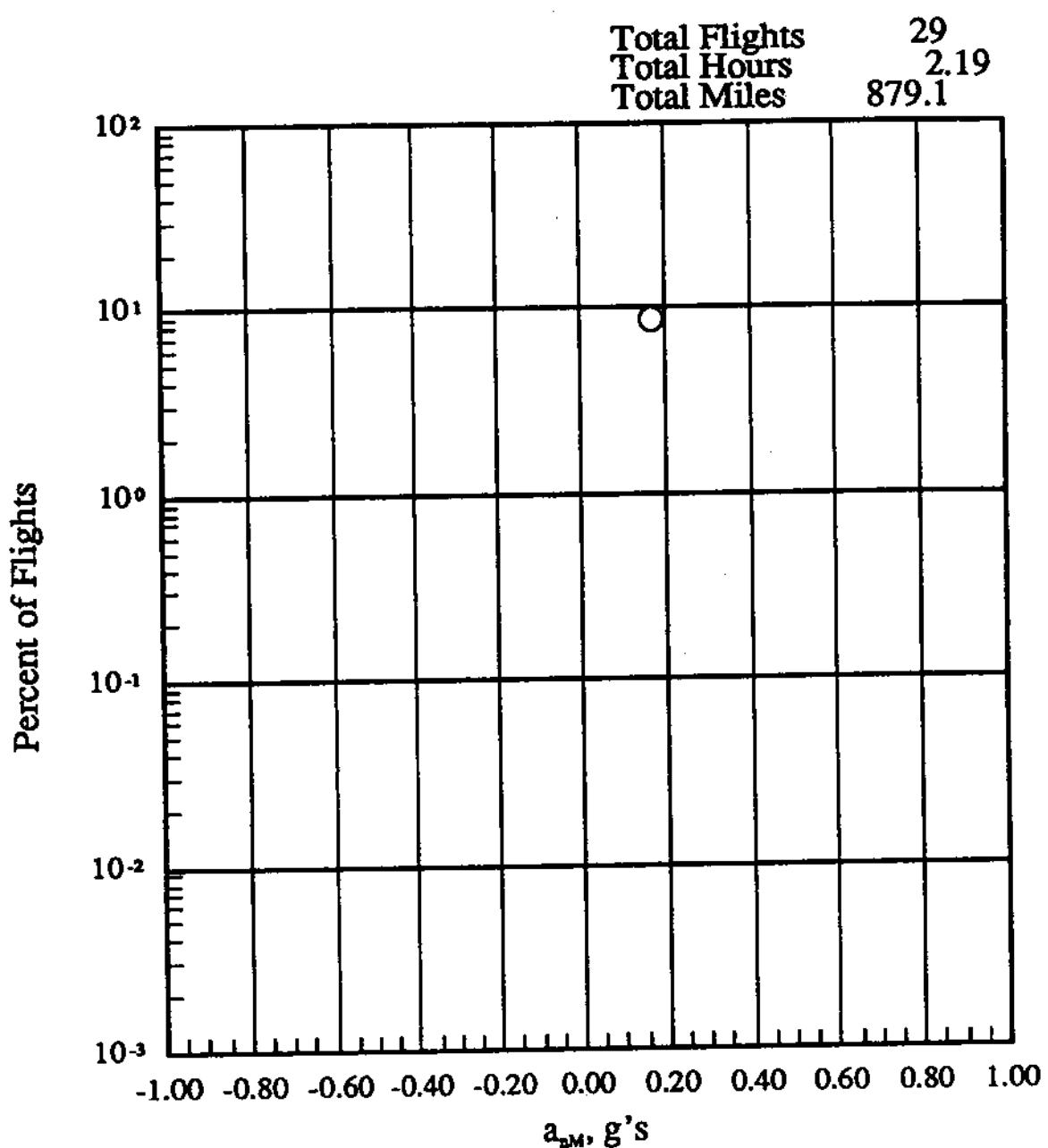
(c) 4500 to 9500 feet altitude

Figure 17.- Continued.



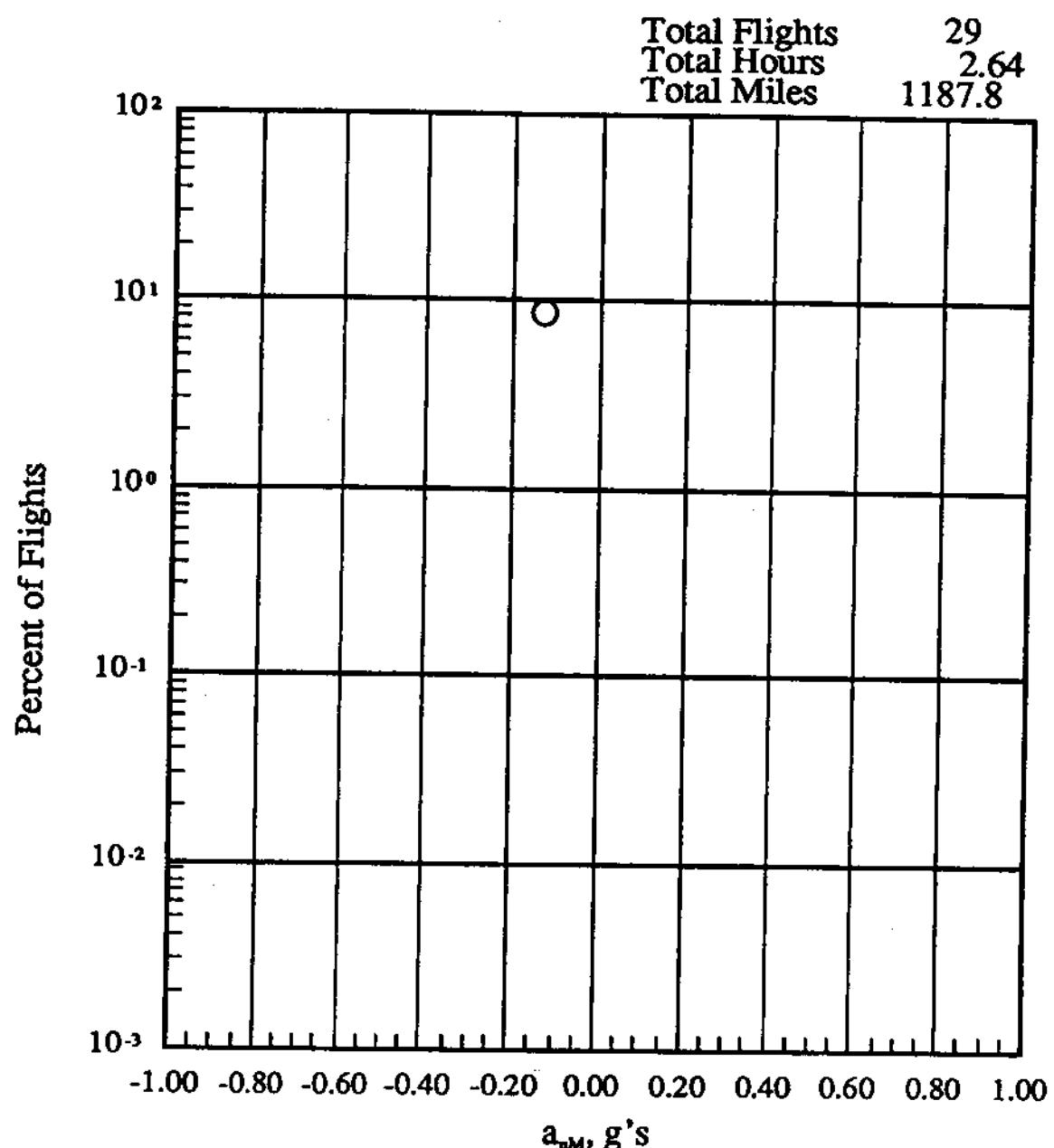
(d) 9500 to 14500 feet altitude

Figure 17.- Continued.



(e) 14500 to 19500 feet altitude

Figure 17.- Continued.



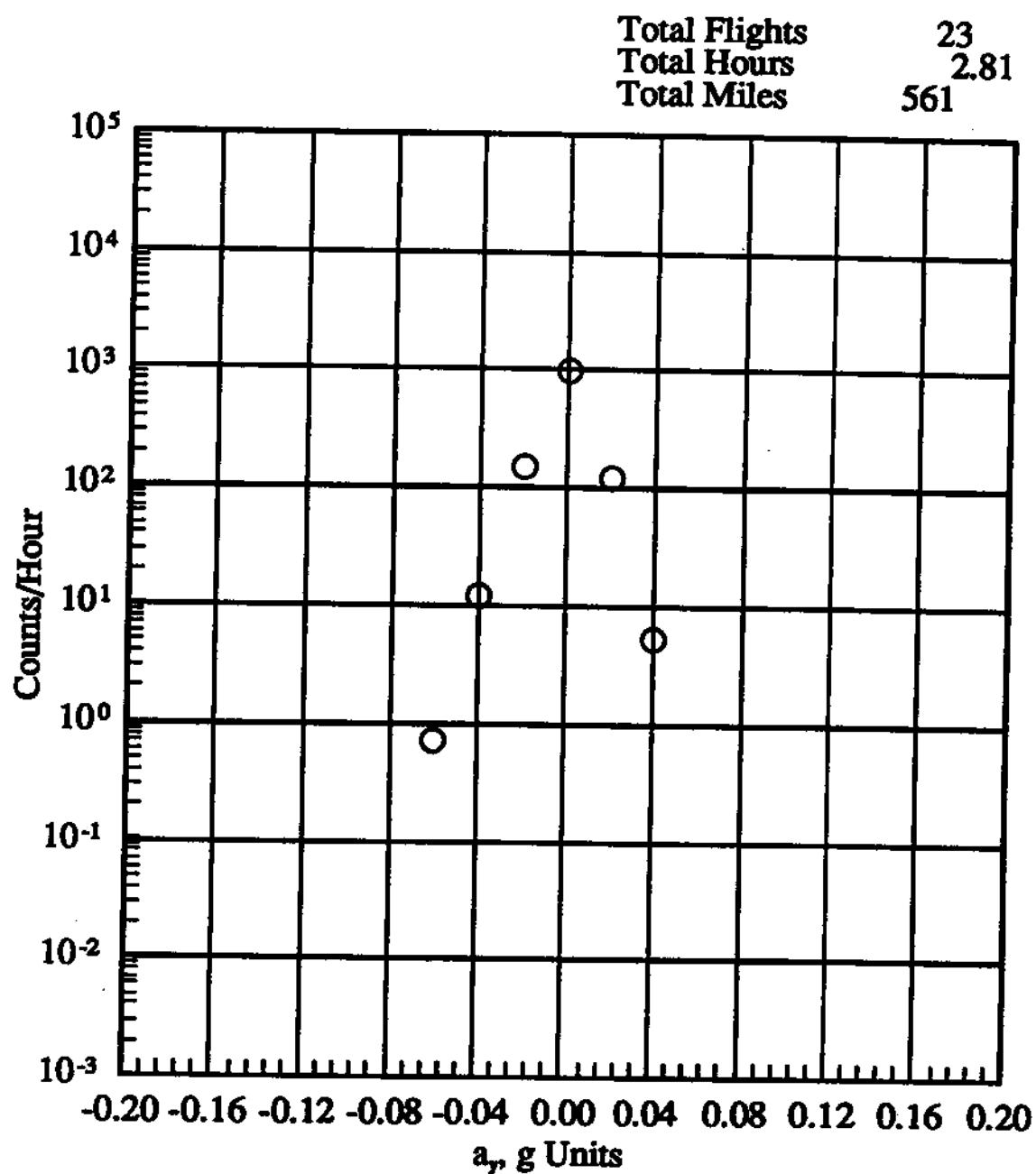
(f) 19500 to 24500 feet altitude

Figure 17.- Continued.

$a_y$	LEVEL q's	PRESSURE ALTITUDE BANDS										TOTAL FLIGHTS 23	TOTAL FLIGHT HOURS 126.92	TOTAL FLIGHT MILES 59904.53
		-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT	44500 TO 49500 FT			
.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
.04	5.33	1.96	10.24	1.88	0.76	0.21	0.12	0.35	0.35	0.35	0.63	0.63	0.63	0.63
.02	122.93	75.49	61.03	39.42	20.86	6.18	5.23	6.66	6.66	6.66	11.93	11.93	11.93	11.93
0	994.49	928.94	846.70	672.31	836.57	906.96	1917.52	1218.20	1218.20	1218.20	1195.95	1195.95	1195.95	1195.95
-.02	152.97	53.98	49.97	59.59	29.34	6.07	4.24	4.45	4.45	4.45	10.79	10.79	10.79	10.79
-.04	12.08	2.74	6.96	4.69	1.90	0.42	0.17	0.35	0.35	0.35	0.83	0.83	0.83	0.83
-.06	0.71	0	1.64	0.47	0	0	0	0.07	0.07	0.07	0.07	0.07	0.07	0.07
-.08	0	0	0.62	0	0	0	0	0	0	0	0.02	0.02	0.02	0.02
-.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLIGHT HOURS @ ALT	2.91	2.56	2.44	2.13	2.64	9.55	41.46	65.92	65.92	65.92	0	0	0	0
FLIGHT MILES @ ALT	561.49	714.53	878.79	879.09	1187.79	4636.71	19917.03	31127.09	31127.09	31127.09	0	0	0	0
TOTAL FLIGHTS	23													
TOTAL FLIGHT HOURS FLAPS UP AND DOWN														
TOTAL FLIGHT MILES FLAPS UP AND DOWN														

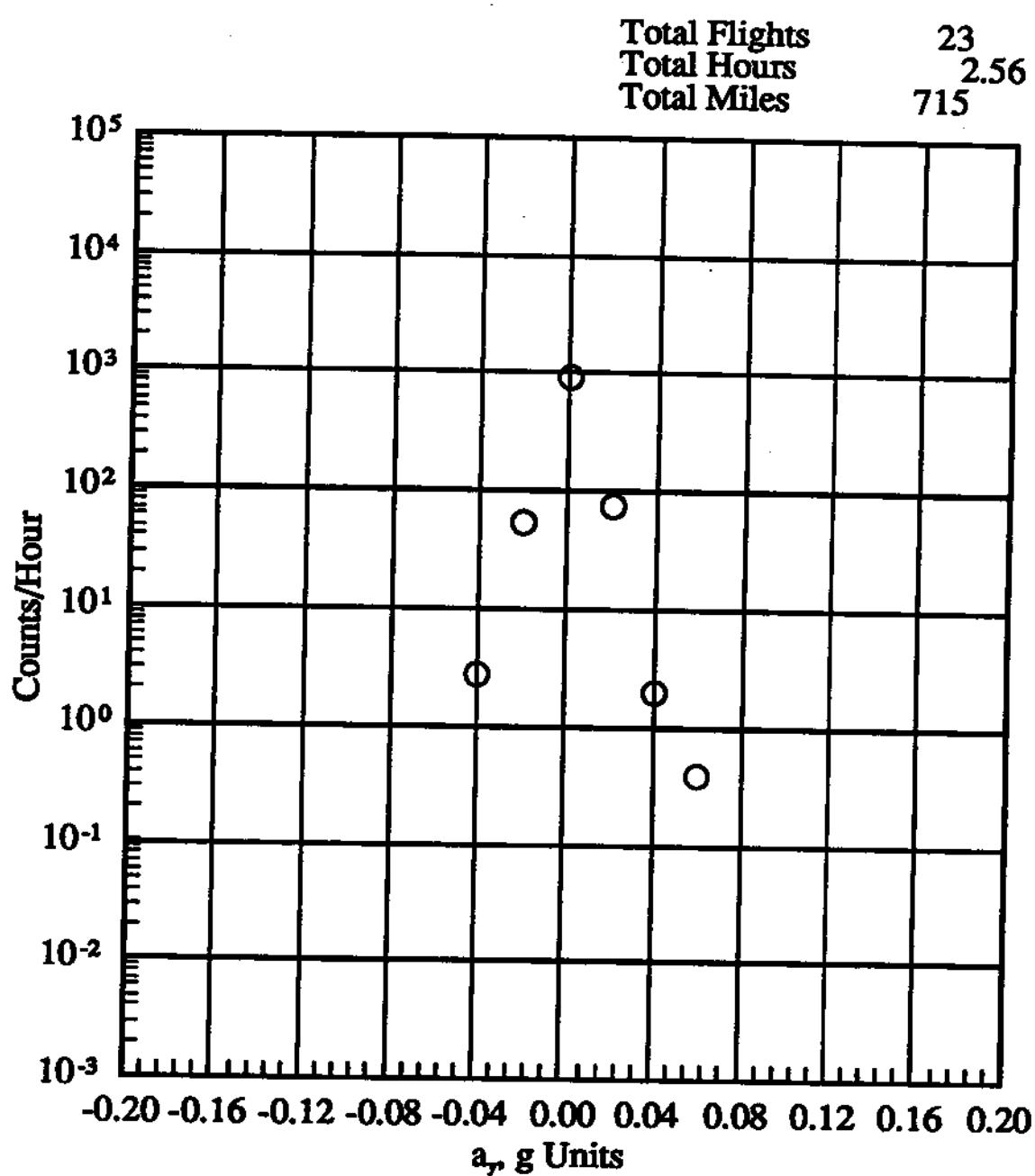
(a)  $a_y$  Level crossing counts per hour within pressure altitude bands

Figure 14.- Lateral acceleration exceedances.



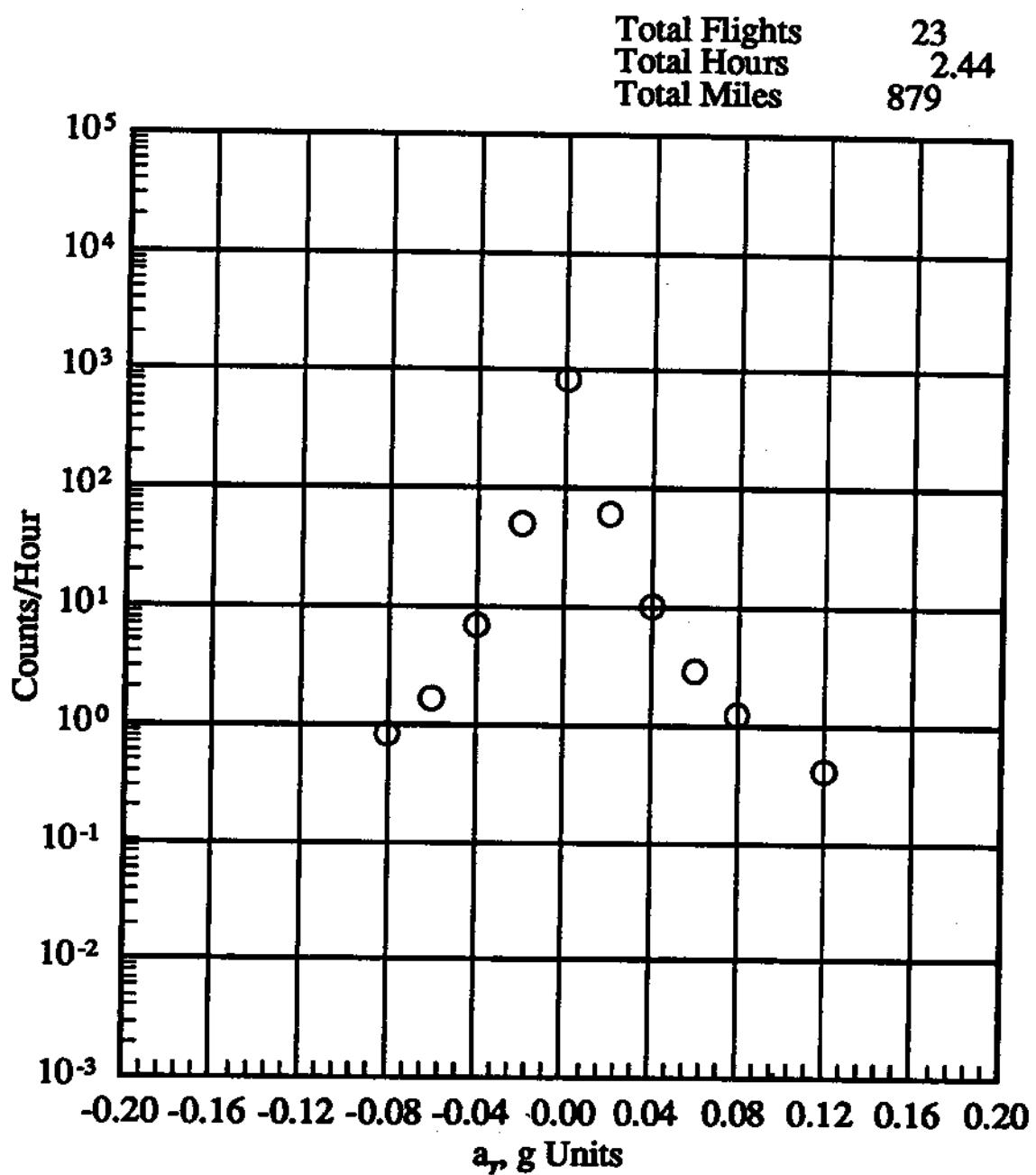
(b) -500 to 4500 feet altitude

Figure 14.- Continued.



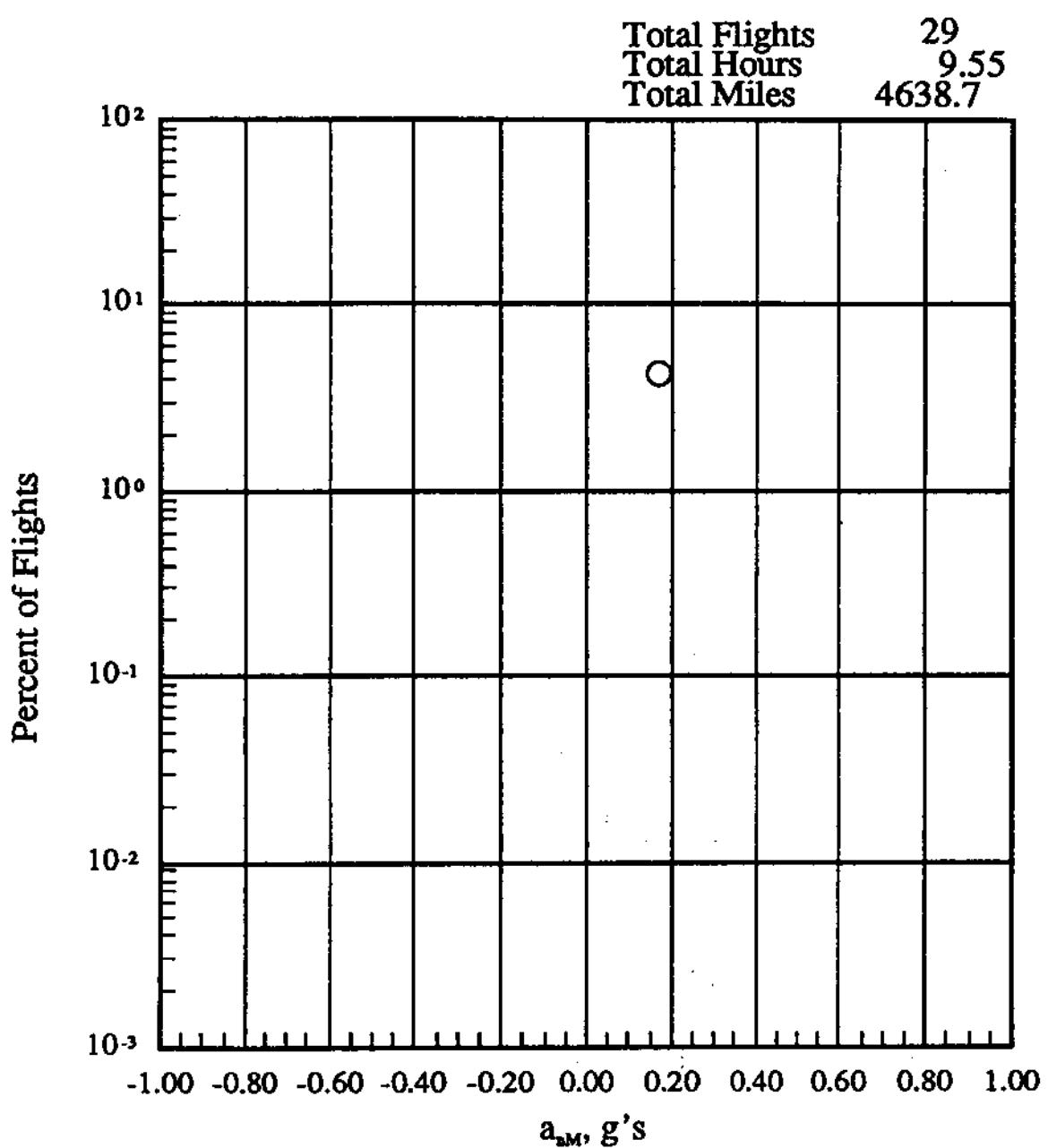
(c) 4500 to 9500 feet altitude

Figure 14.- Continued.



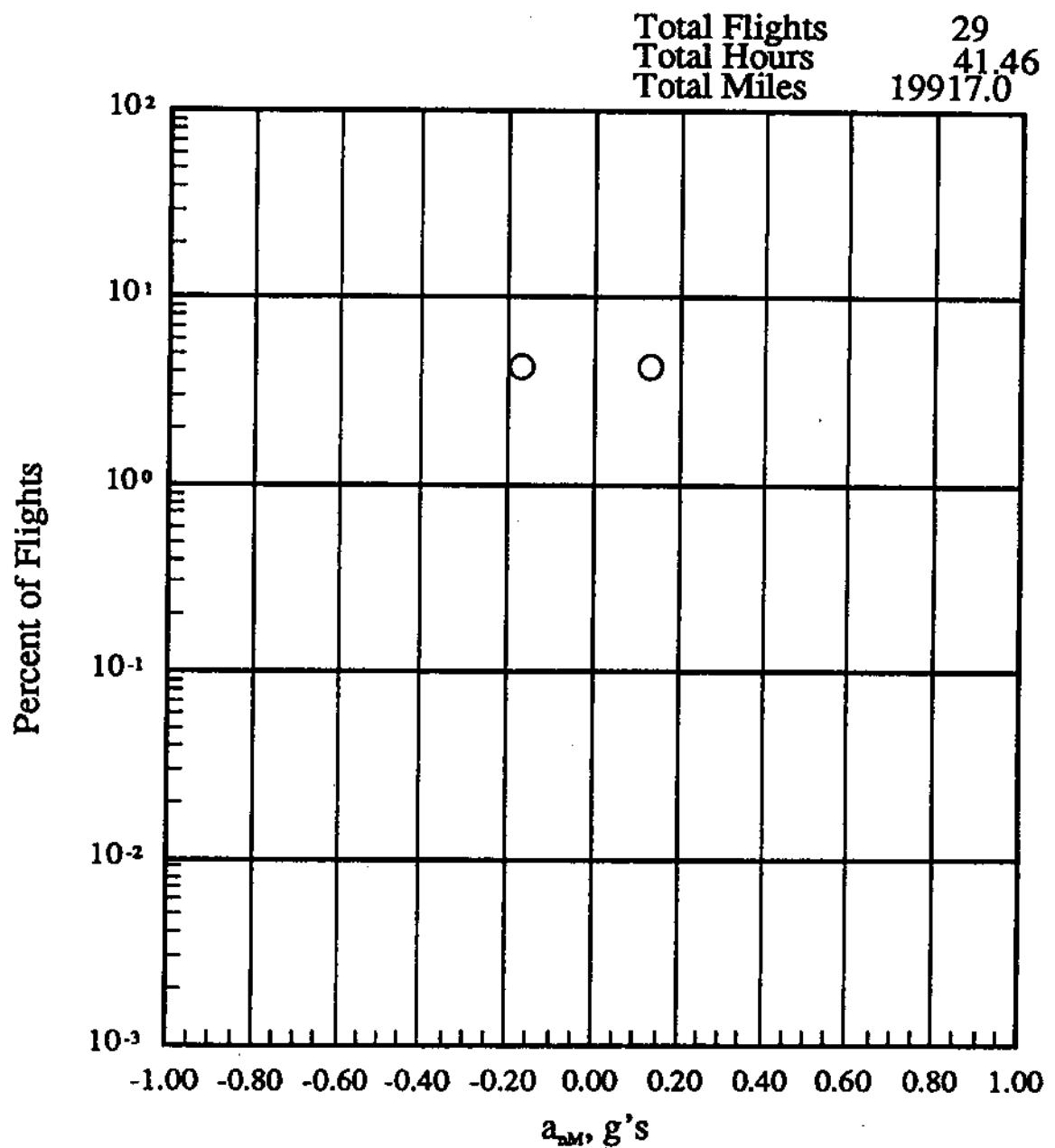
(d) 9500 to 14500 feet altitude

Figure 14.- Continued.



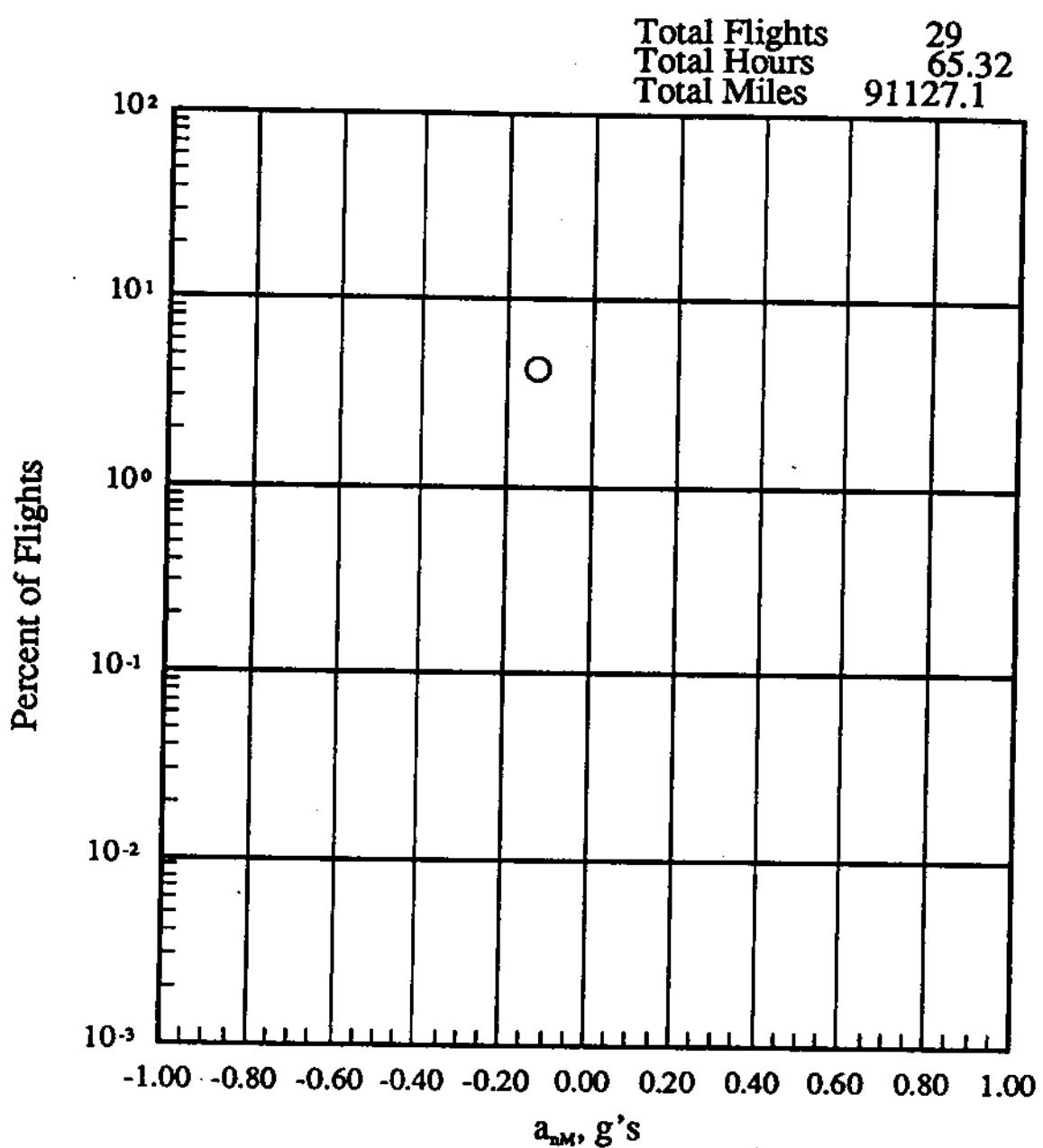
(g) 24500 to 29500 feet altitude

Figure 17.- Continued.



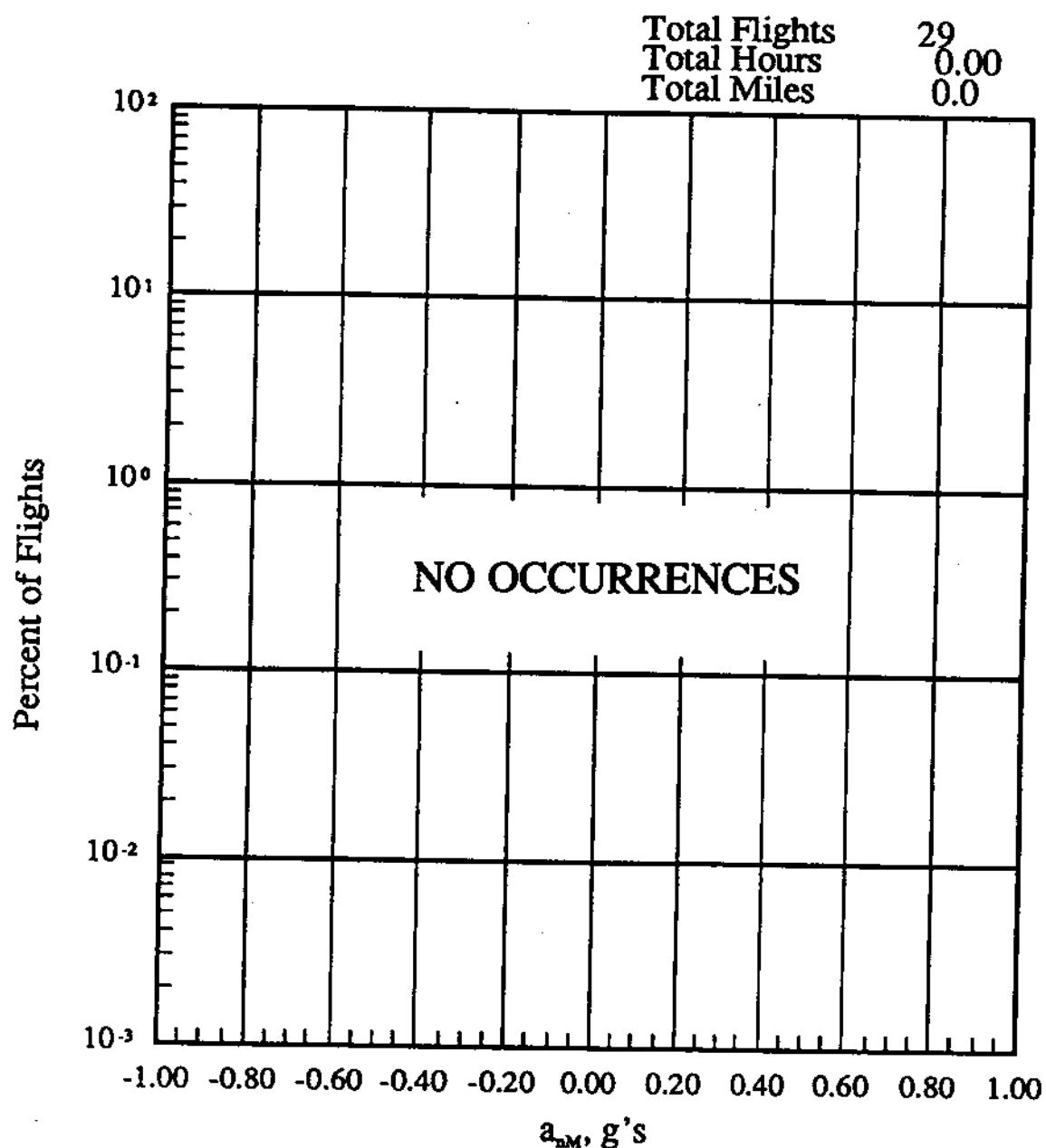
(h) 29500 to 34500 feet altitude

Figure 17.- Continued.



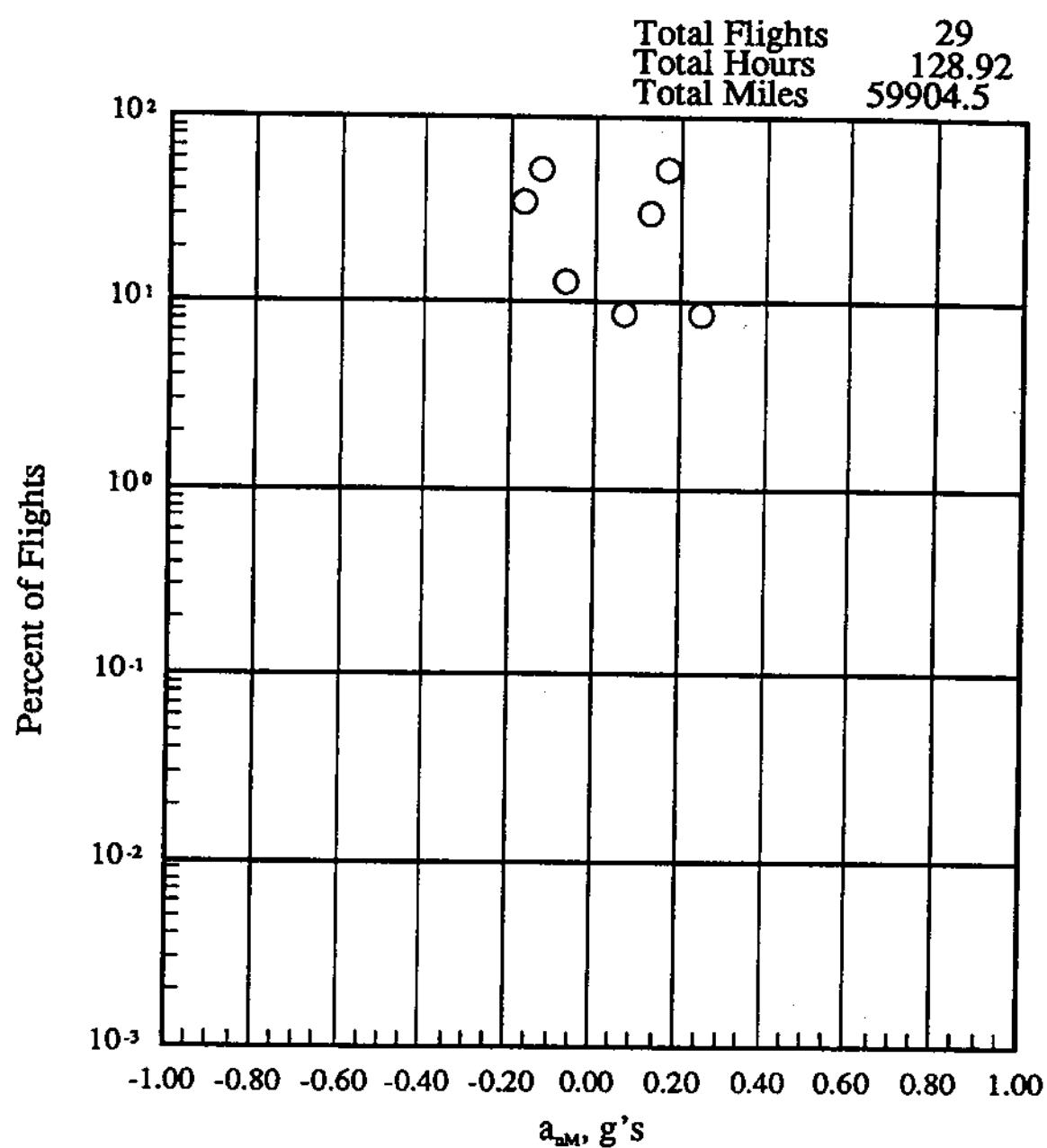
(i) 34500 to 39500 feet altitude

Figure 17.- Continued.



(j) 39500 to 44500 feet altitude

Figure 17.- Continued.



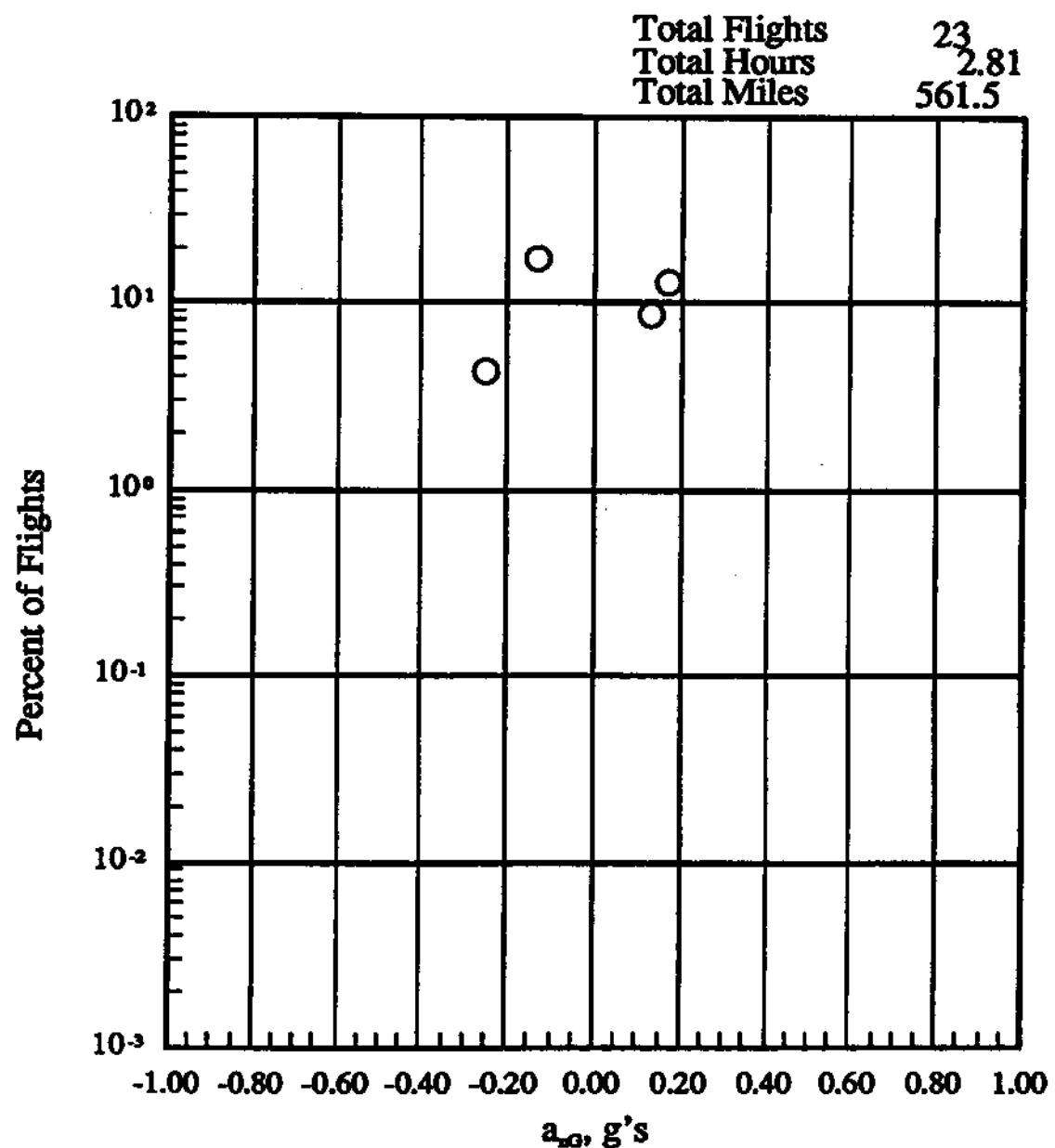
(k) -500 to 44500 feet altitude

Figure 17.- Concluded.

MAXIMUM $a_{nG}$	LEVEL FOR EACH FLIGHT $a^{\prime}_{nG}$ FROM TO	PRESSURE ALTITUDE BANDS										TOTAL FLIGHTS
		-500 TO 4500 FT	4500 TO 9500 FT	9500 TO 14500 FT	14500 TO 19500 FT	19500 TO 24500 FT	24500 TO 29500 FT	29500 TO 34500 FT	34500 TO 39500 FT	39500 TO 44500 FT	-500 TO 44500 FT	
1.60	1.80	0	0	0	0	0	0	0	0	0	0	0
1.40	1.60	0	0	0	0	0	0	0	0	0	0	0
1.20	1.40	0	0	0	0	0	0	0	0	0	0	0
1.00	1.20	0	0	0	0	0	0	0	0	0	0	0
.80	1.00	0	0	0	0	0	0	0	0	0	0	0
.70	0.80	0	0	0	0	0	0	0	0	0	0	0
.60	0.70	0	0	0	0	0	0	0	0	0	0	0
.50	0.60	0	0	0	0	0	0	0	0	0	0	0
.40	0.50	0	0	0	0	0	0	0	0	0	0	0
.30	0.40	0	0	0	0	0	0	0	0	0	0	0
.20	0.30	0	0	0	0	0	0	0	0	0	0	0
.15	0.20	0	0	0	0	0	0	0	0	0	0	0
.10	0.15	0	0	0	0	0	0	0	0	0	0	0
.05	0.10	0	0	0	0	0	0	0	0	0	0	0
-.05	-.10	0	0	0	0	0	0	0	0	0	0	0
-.10	-.15	17.4	0	0	0	0	0	0	0	0	0	0
-.15	-.20	0	17.4	0	0	0	0	0	0	0	0	0
-.20	-.30	0	4.3	4.3	0	0	0	0	0	0	0	0
-.30	-.40	0	0	0	0	0	0	0	0	0	0	0
-.40	-.50	0	0	0	0	0	0	0	0	0	0	0
-.50	-.60	0	0	0	0	0	0	0	0	0	0	0
-.60	-.70	0	0	0	0	0	0	0	0	0	0	0
-.70	-.80	0	0	0	0	0	0	0	0	0	0	0
-.80	-.90	0	0	0	0	0	0	0	0	0	0	0
-.90	-1.00	0	0	0	0	0	0	0	0	0	0	0
-1.00	-1.20	0	0	0	0	0	0	0	0	0	0	0
-1.20	-1.40	0	0	0	0	0	0	0	0	0	0	0
-1.40	-1.60	0	0	0	0	0	0	0	0	0	0	0
-1.60	-1.80	0	0	0	0	0	0	0	0	0	0	0
FLIGHT HOURS @ ALT		2.81	2.56	2.44	2.13	2.64	9.55	41.46	65.32	128.92	0	
FLIGHT MILES @ ALT		561.49	714.53	878.79	879.09	1187.79	4638.71	19917.03	31127.10	59904.53	0	
TOTAL FLIGHTS												23

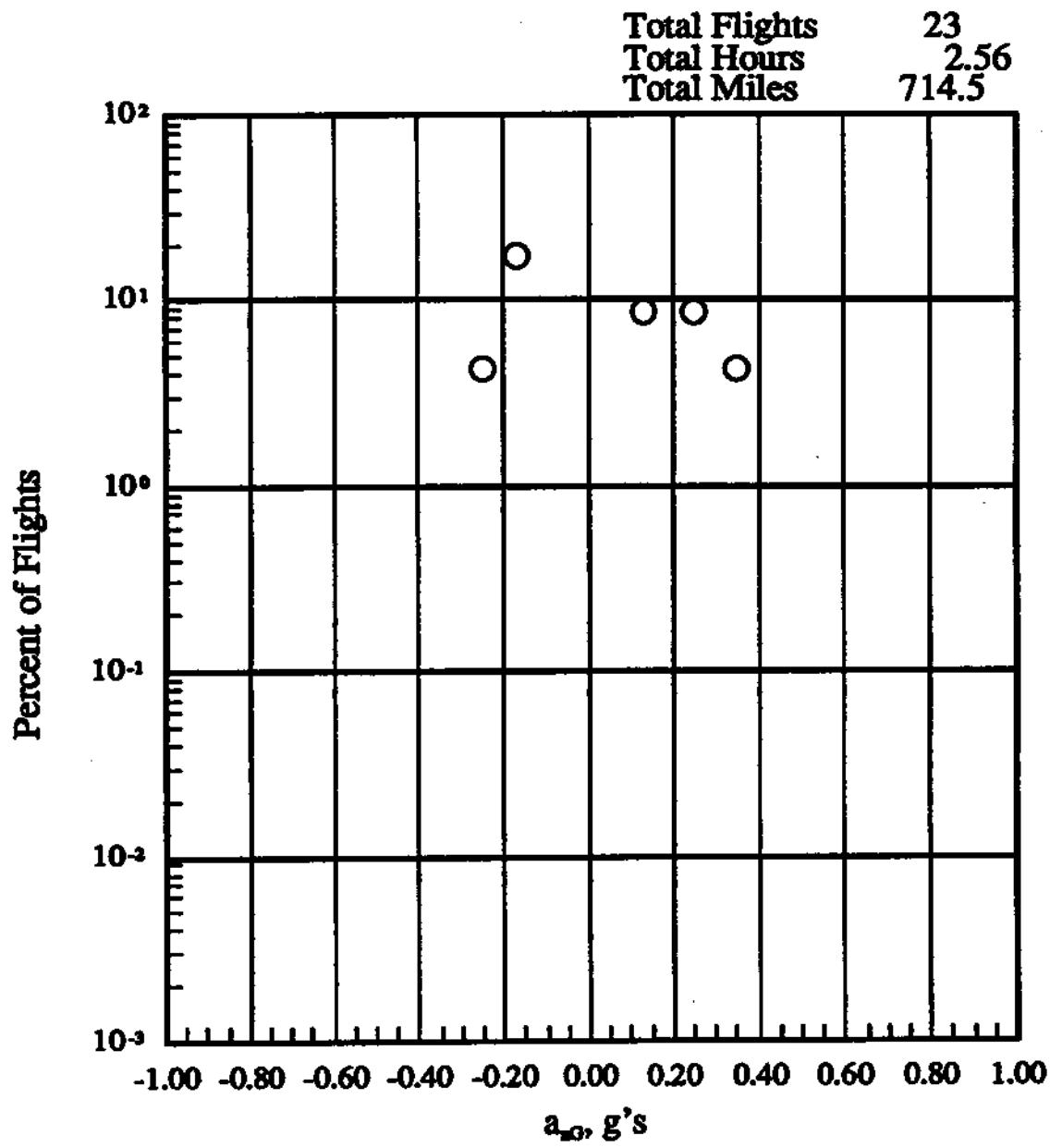
(a) Percent of flights where peak positive and negative  $a_{nG}$  per flight occurs within pressure altitude bands, any flap

Figure 18.- Peak positive and negative  $a_{nG}$  vs altitude.



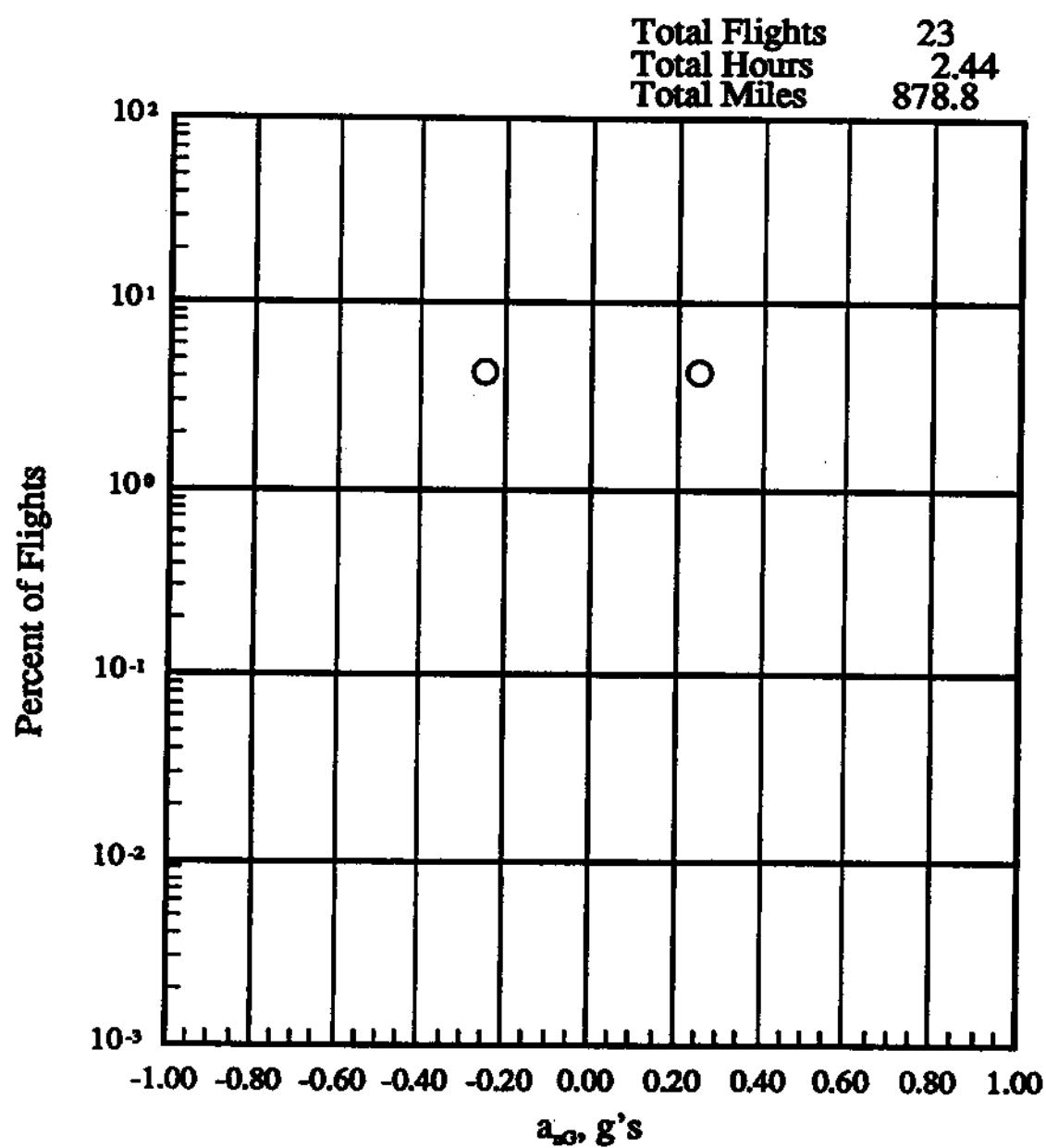
(b) -500 to 4500 feet altitude

Figure 18.- Continued.



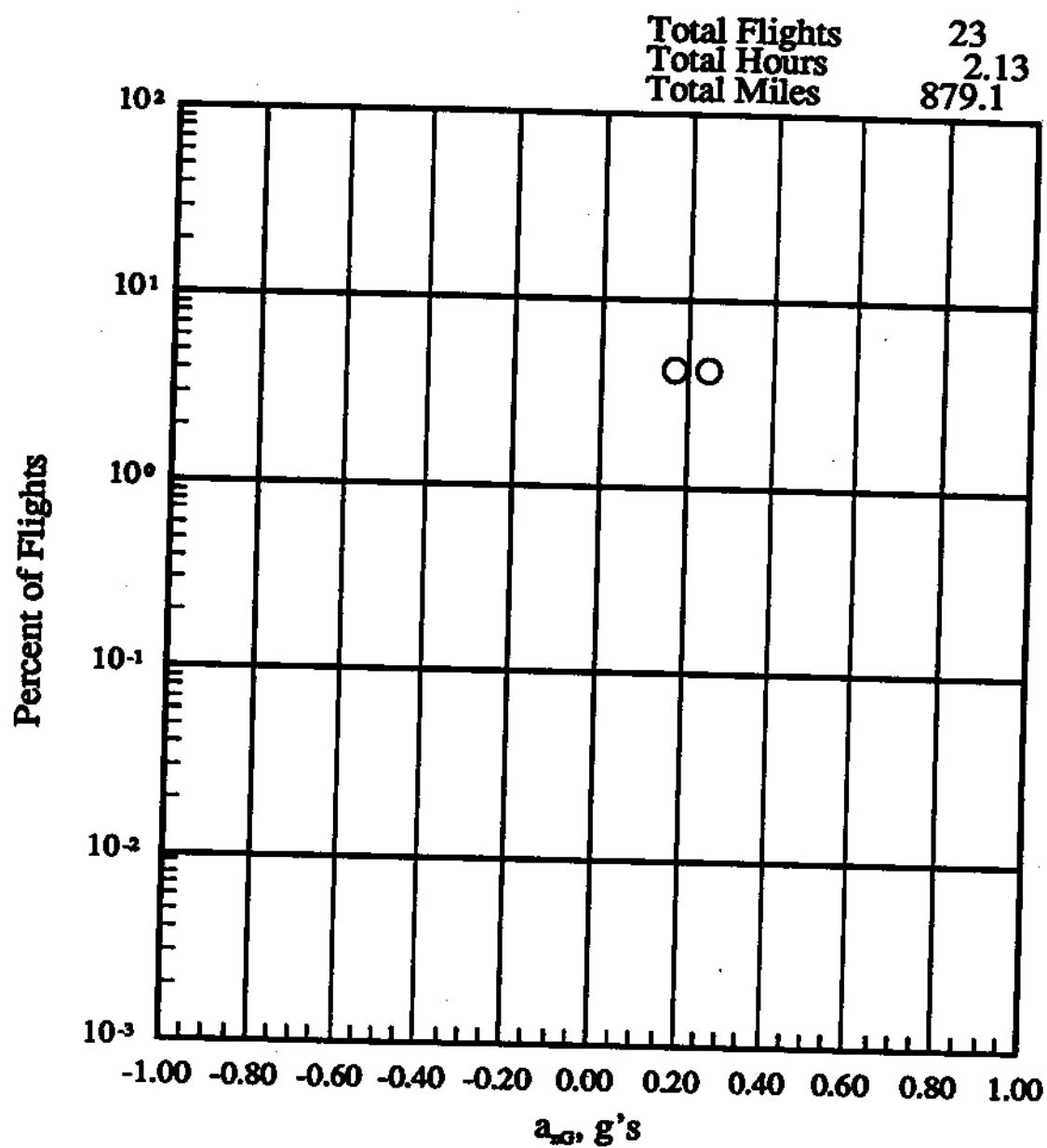
(c) 4500 to 9500 feet altitude

Figure 18.- Continued.



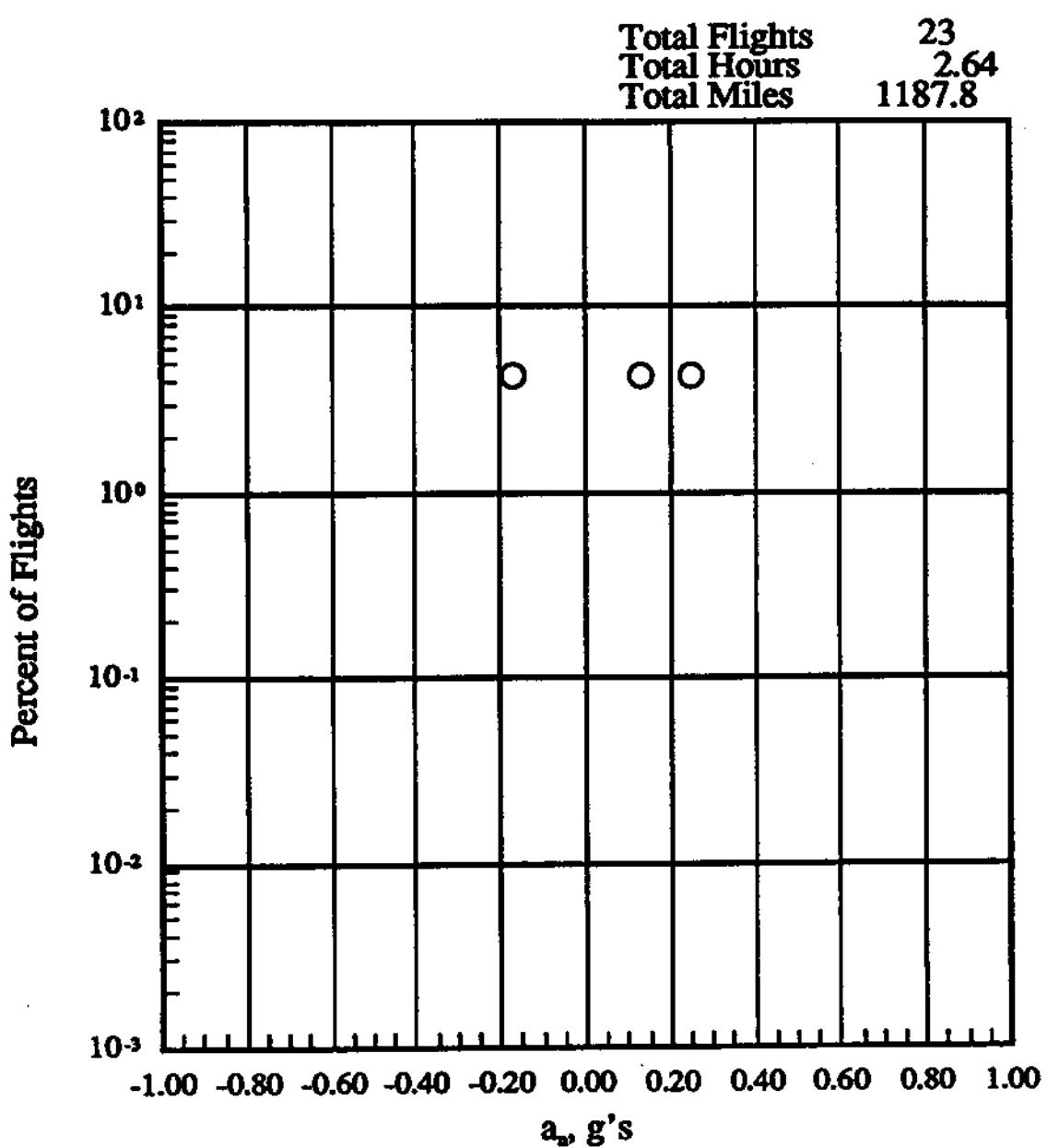
(d) 9500 to 14500 feet altitude

Figure 18.- Continued.



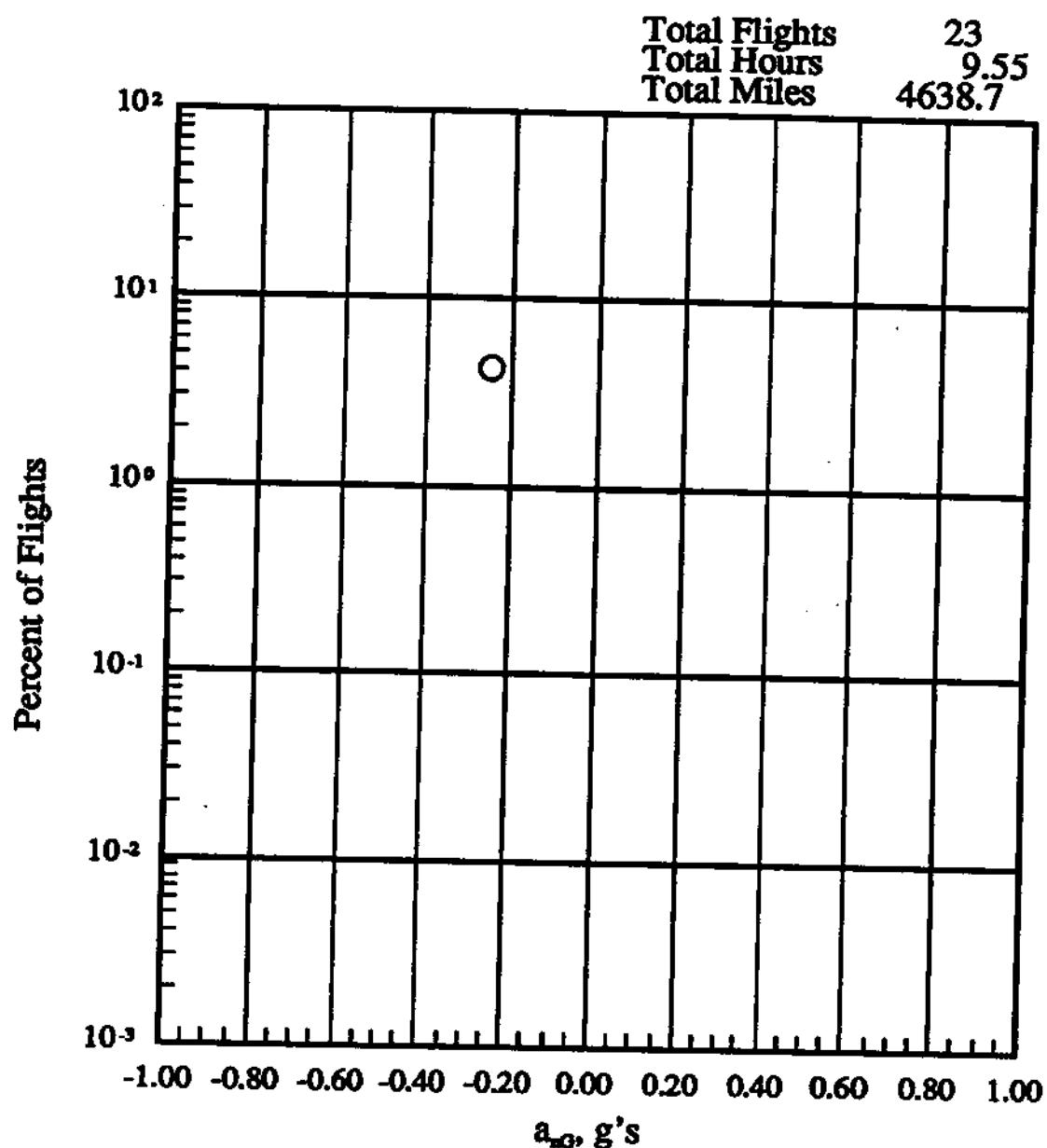
(e) 14500 to 19500 feet altitude

Figure 18.- Continued.



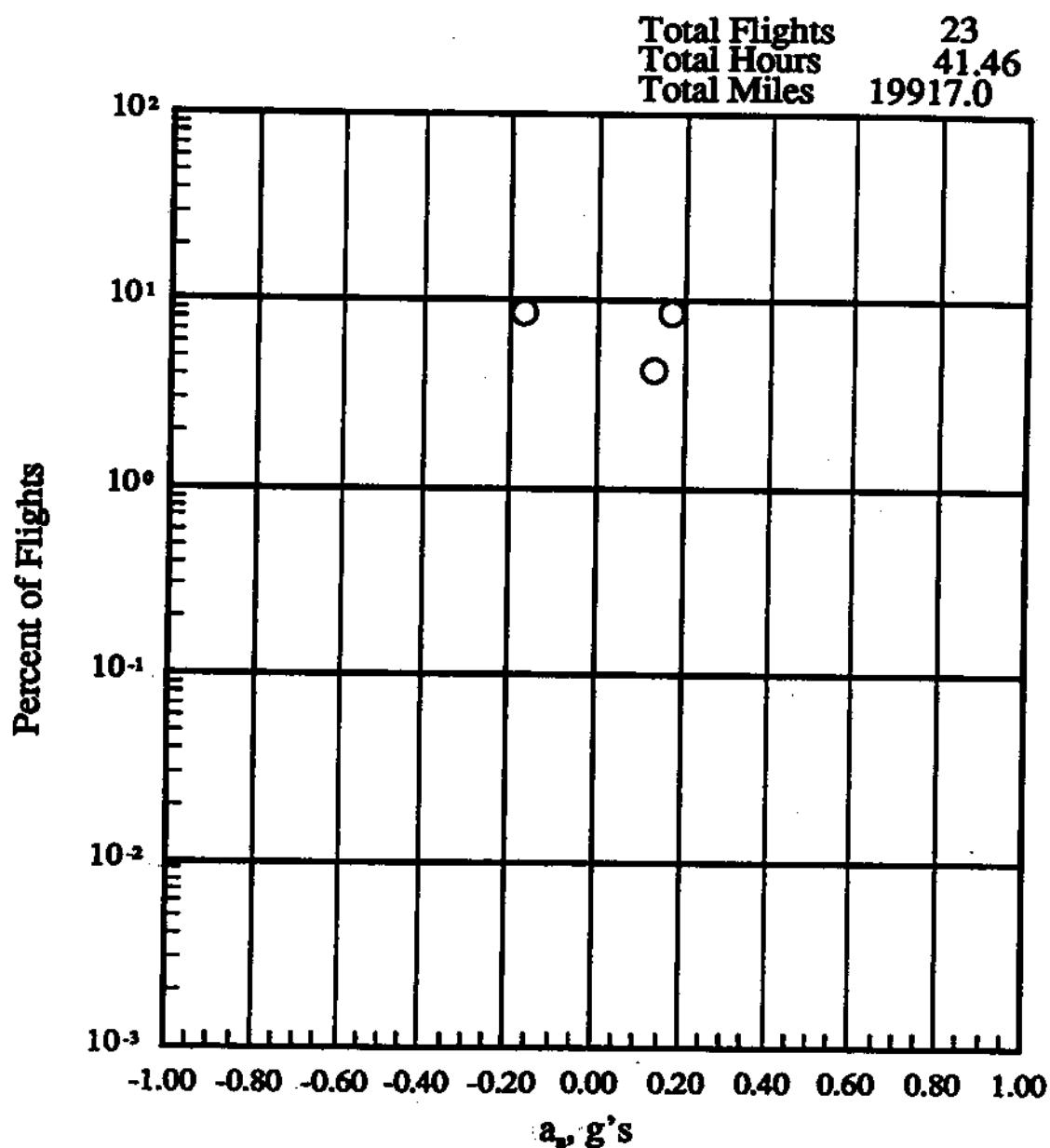
(f) 19500 to 24500 feet altitude

Figure 18.- Continued.



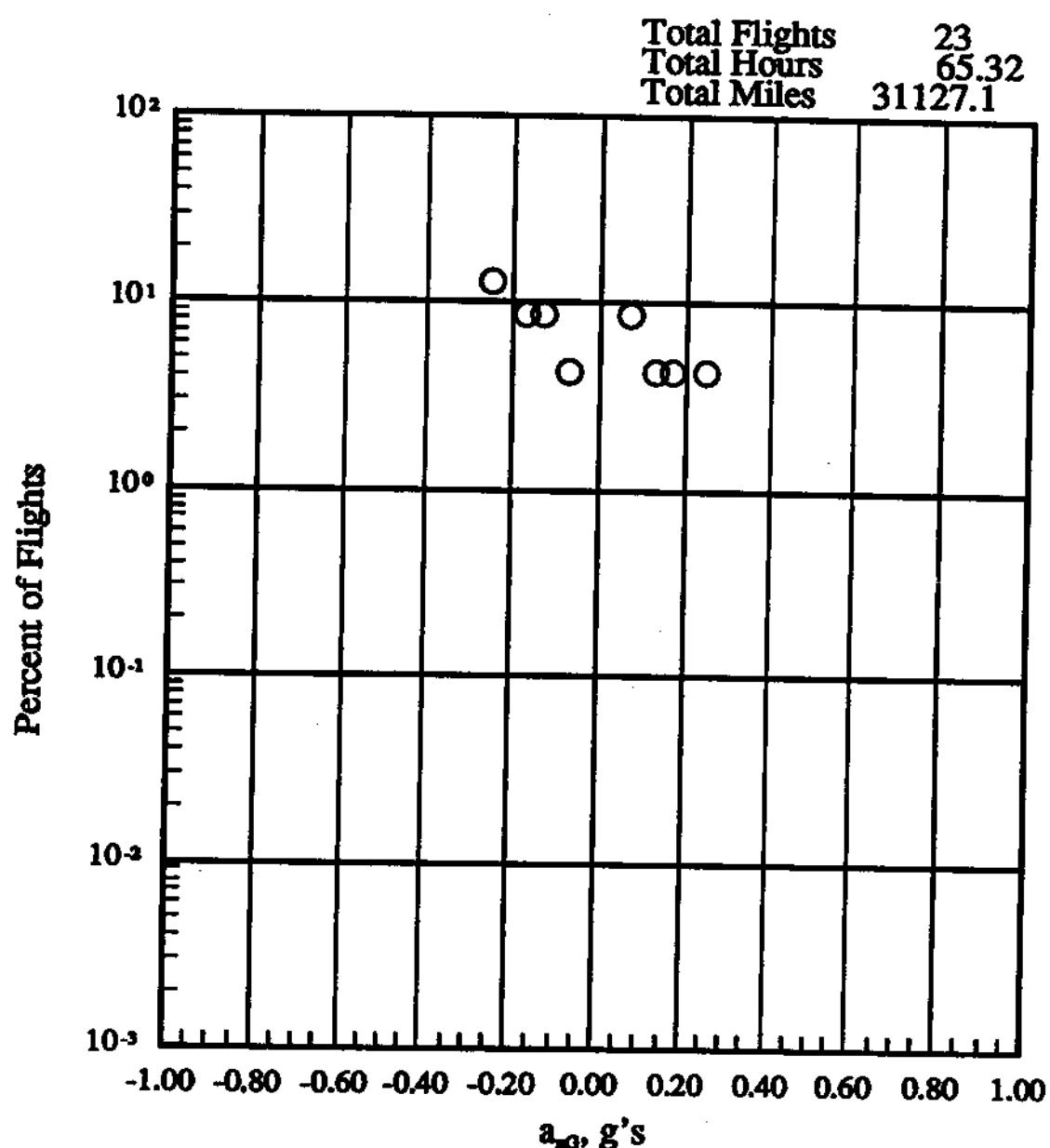
(g) 24500 to 29500 feet altitude

Figure 18.- Continued.



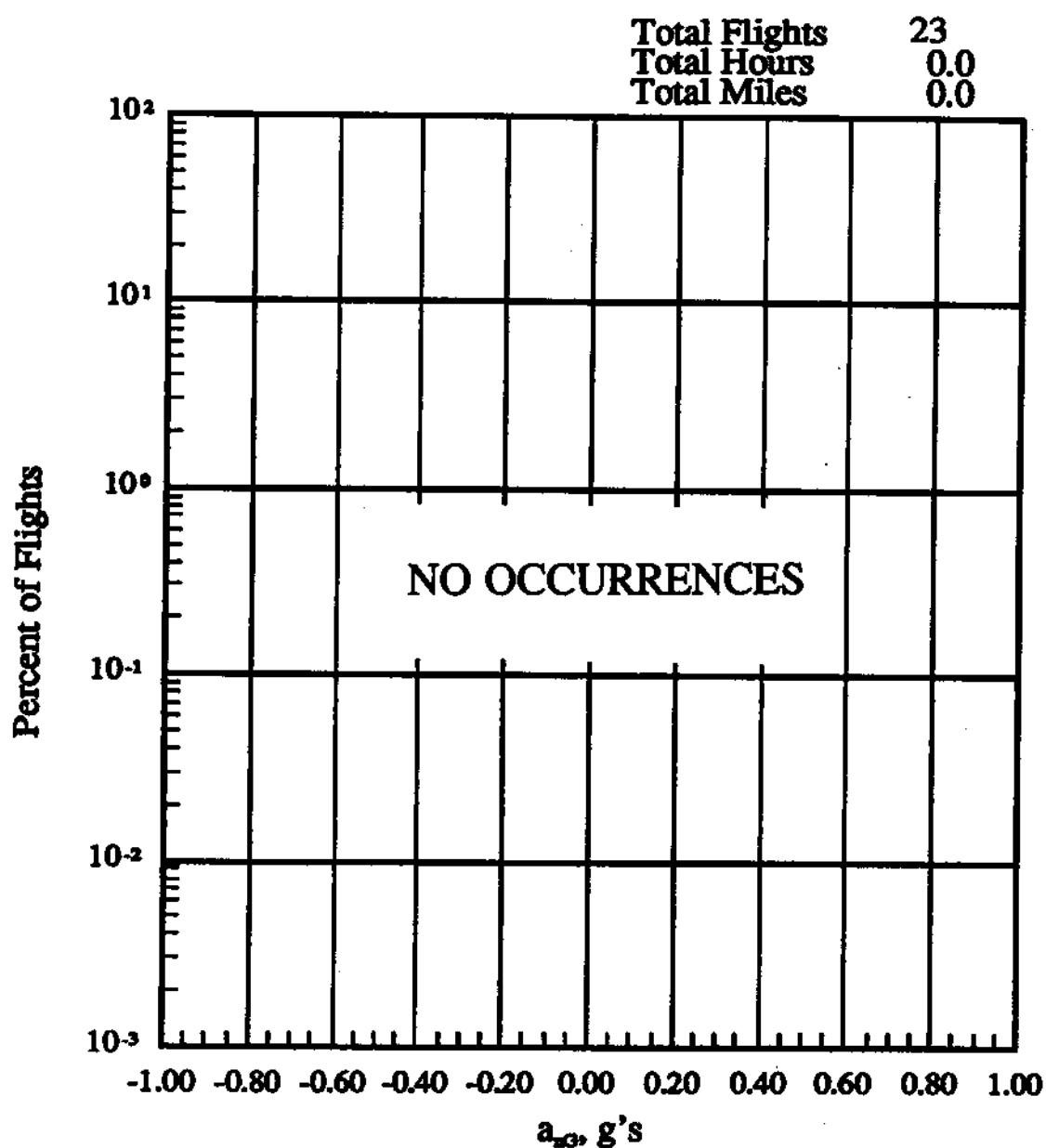
(h) 29500 to 34500 feet altitude

Figure 18.- Continued.



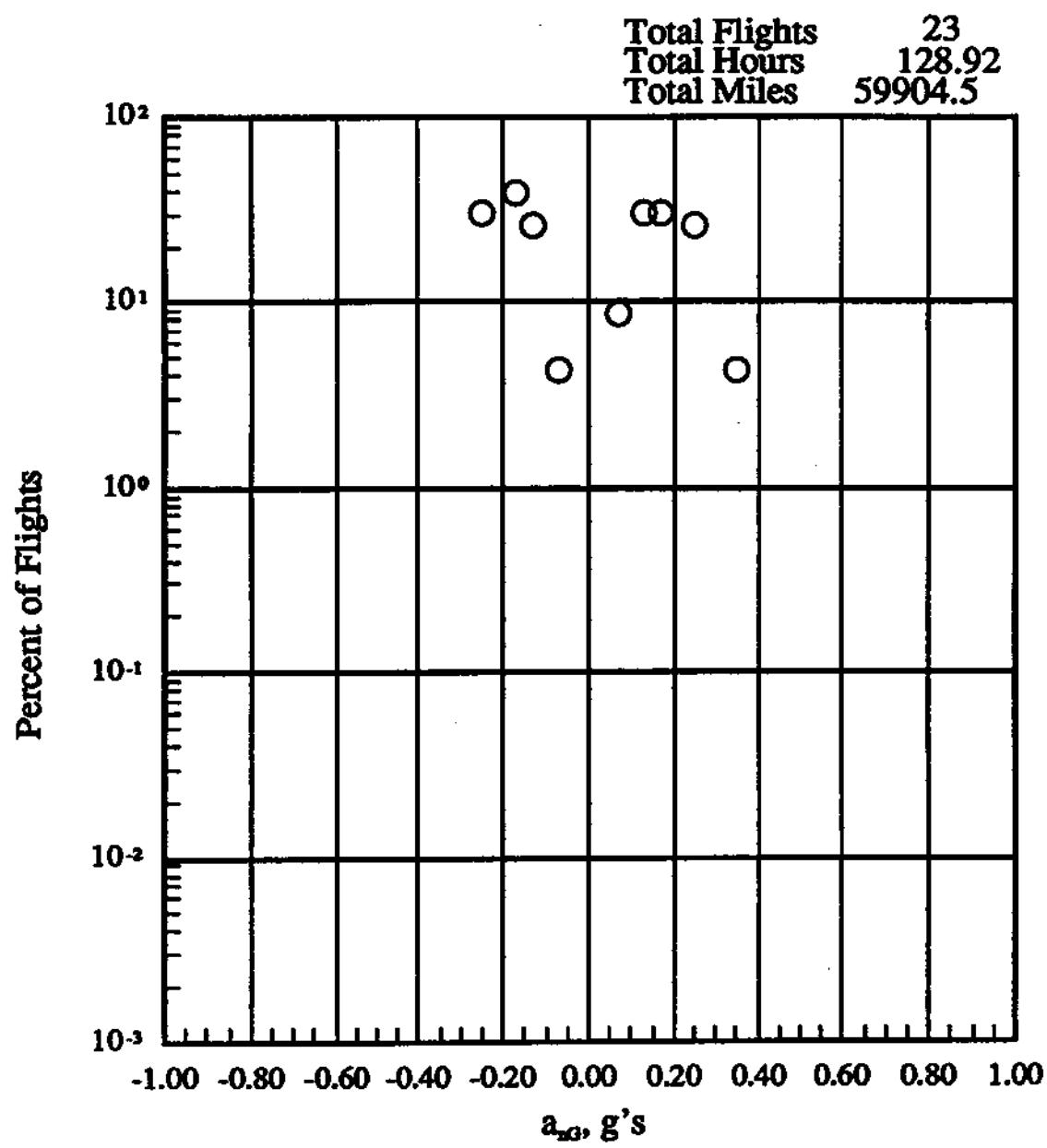
(i) 34500 to 39500 feet altitude

Figure 18.- Continued.



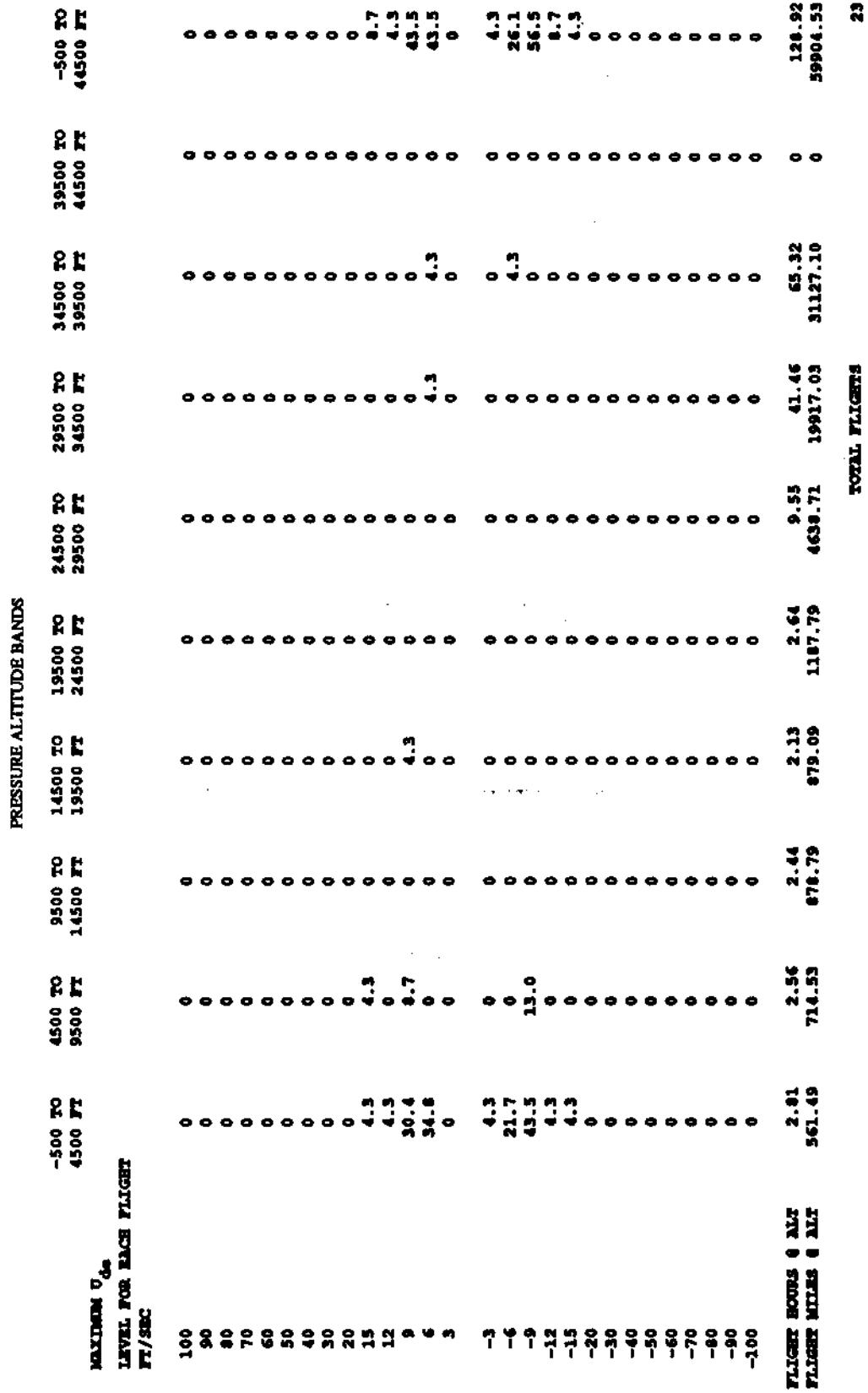
(j) 39500 to 44500 feet altitude

Figure 18.- Continued.



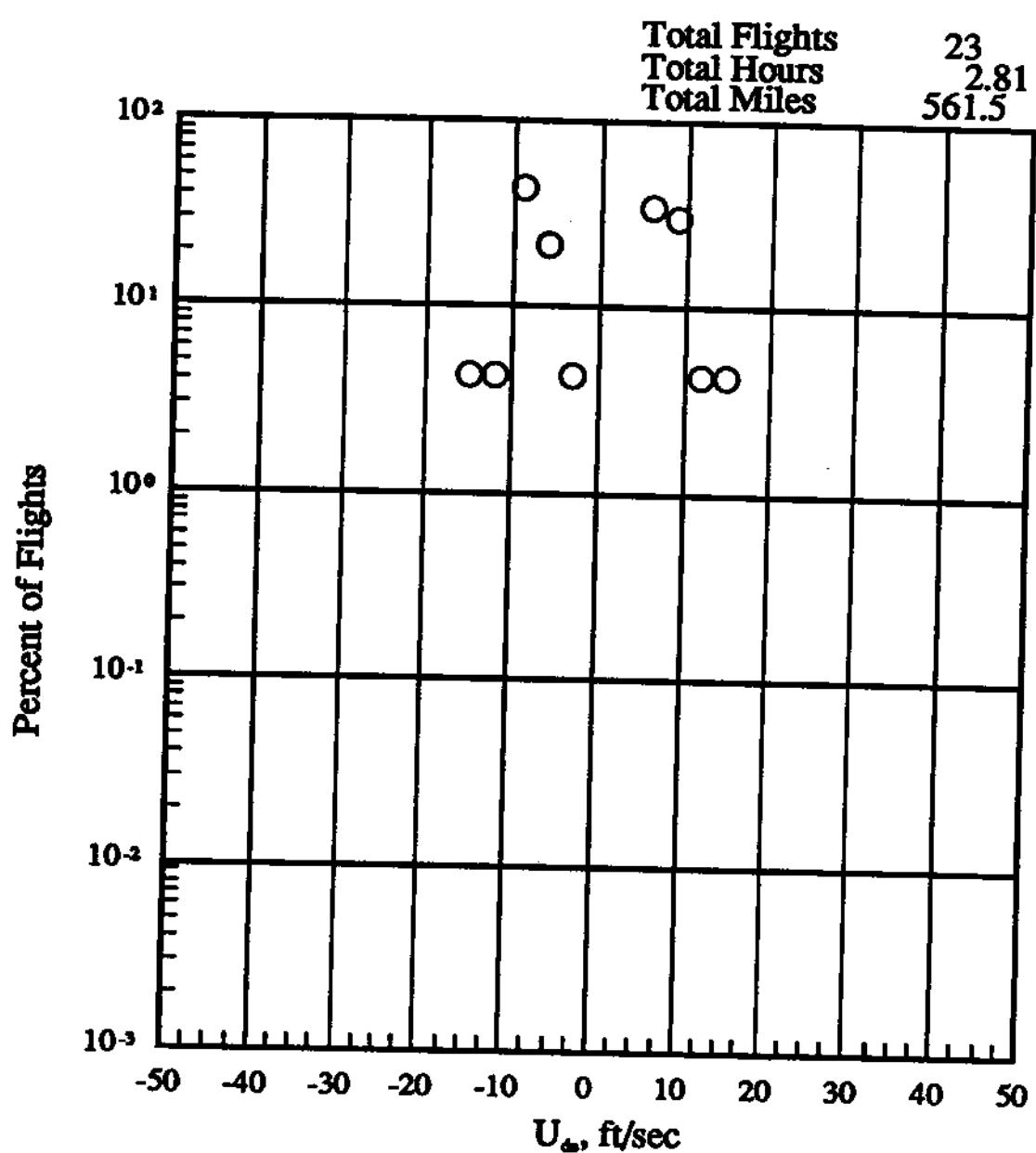
(k) -500 to 44500 feet altitude

Figure 18.- Concluded.



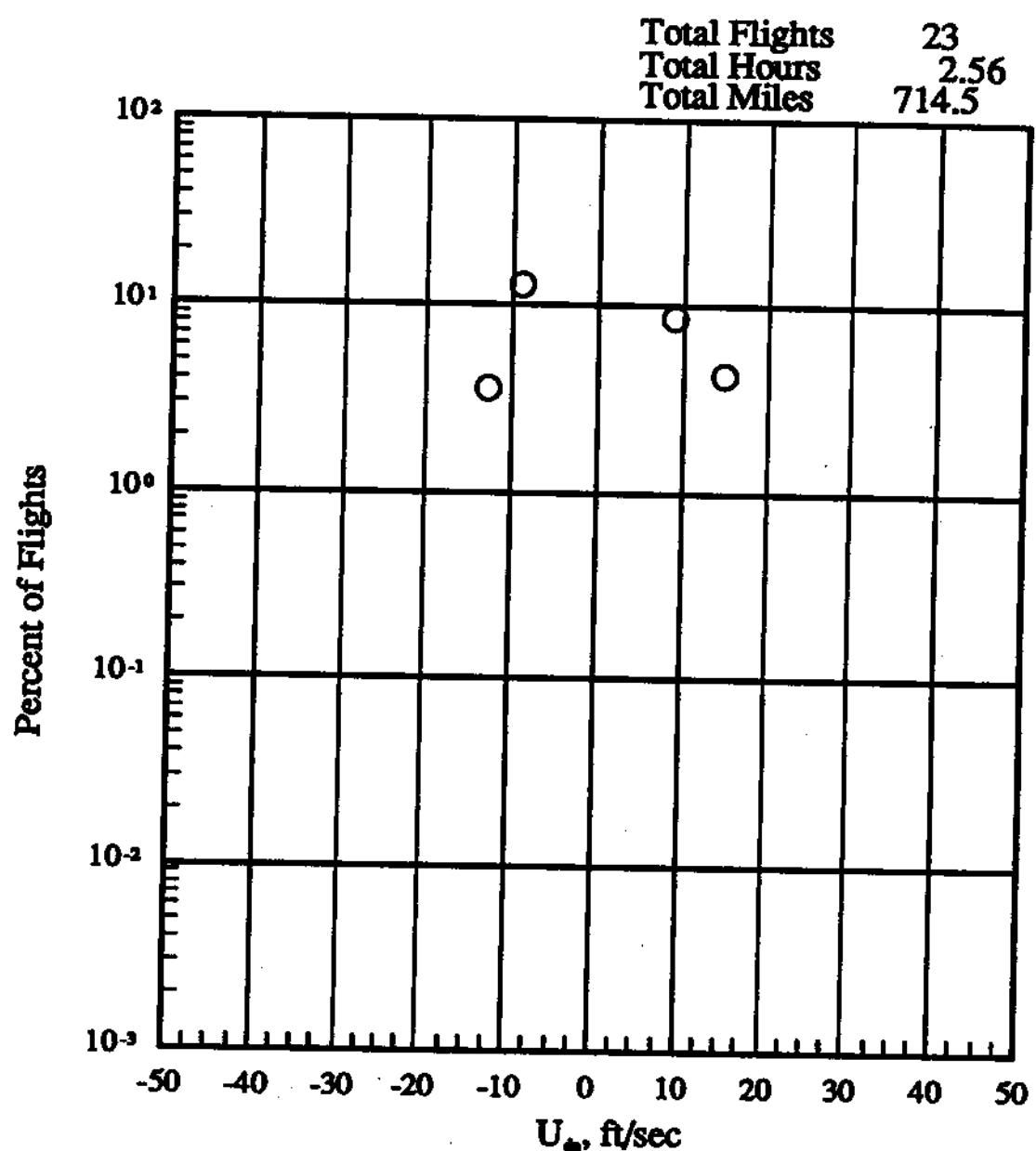
(a) Percent of flights where peak positive and negative  $U_{de}$  per flight occurs within pressure altitude bands, any flap

Figure 19.- Peak positive and negative  $U_{de}$  vs altitude.



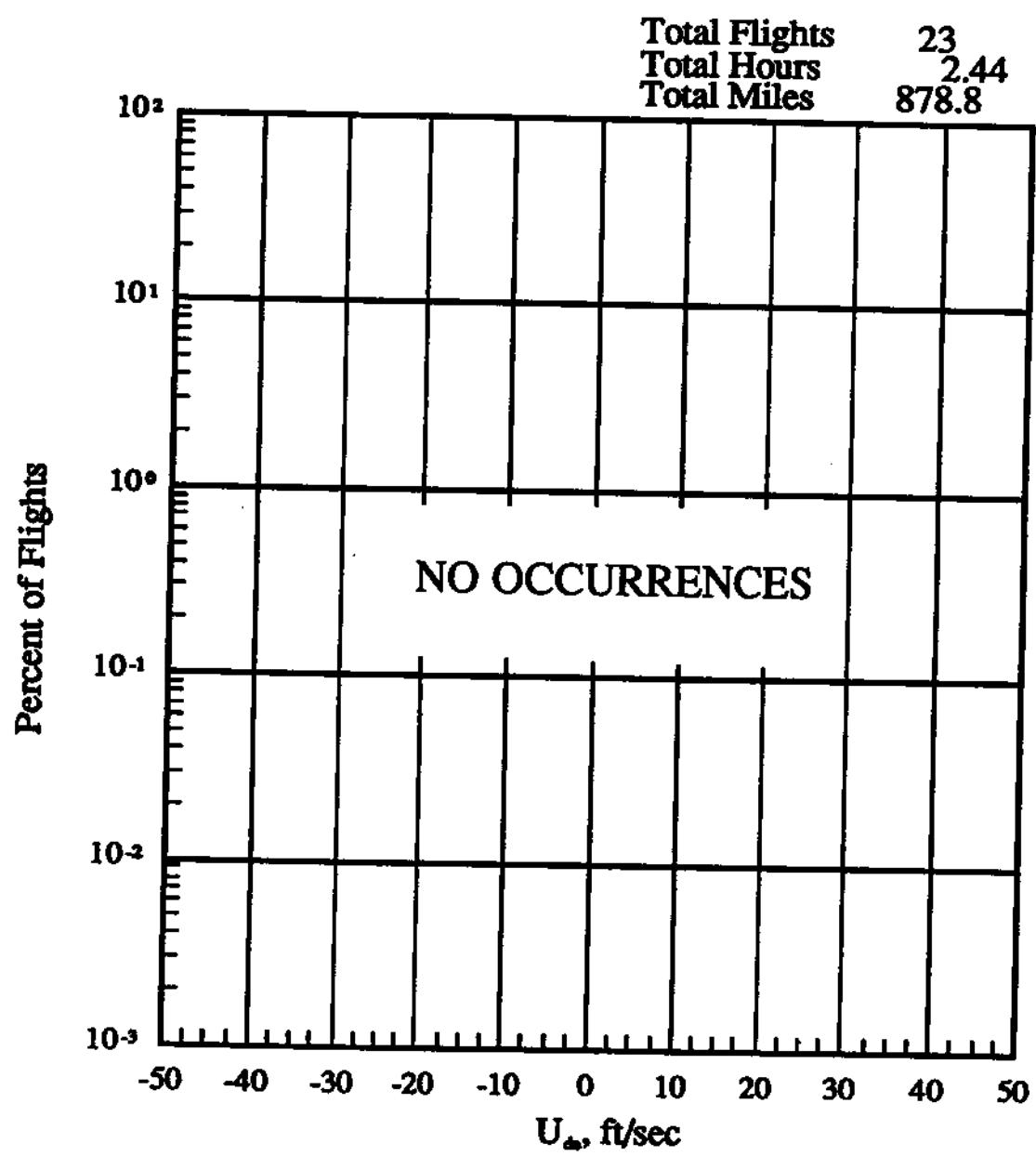
(b) -500 to 4500 feet altitude

Figure 19.- Continued.



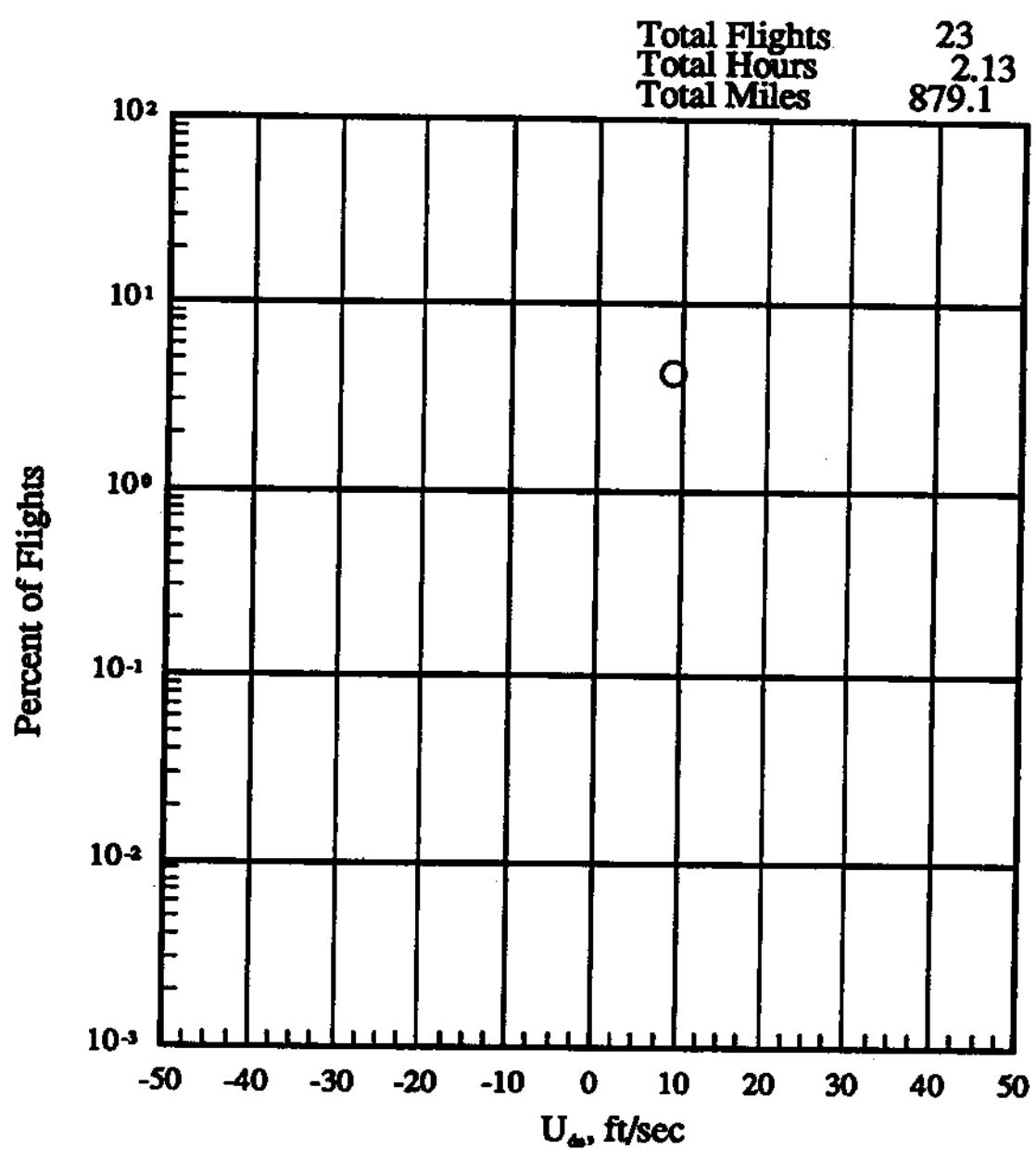
(c) 4500 to 9500 feet altitude

Figure 19.- Continued.



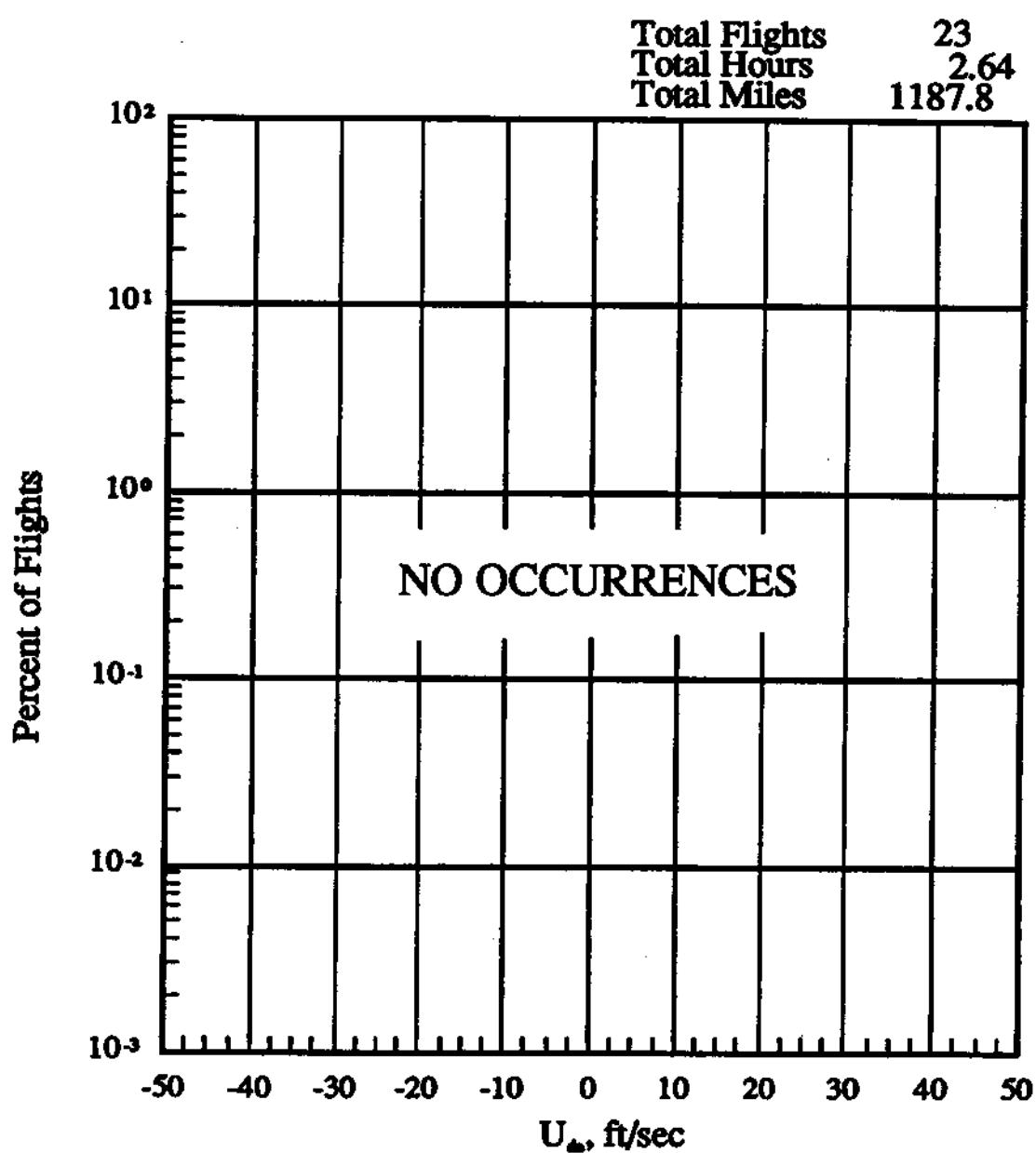
(d) 9500 to 14500 feet altitude

Figure 19.- Continued.



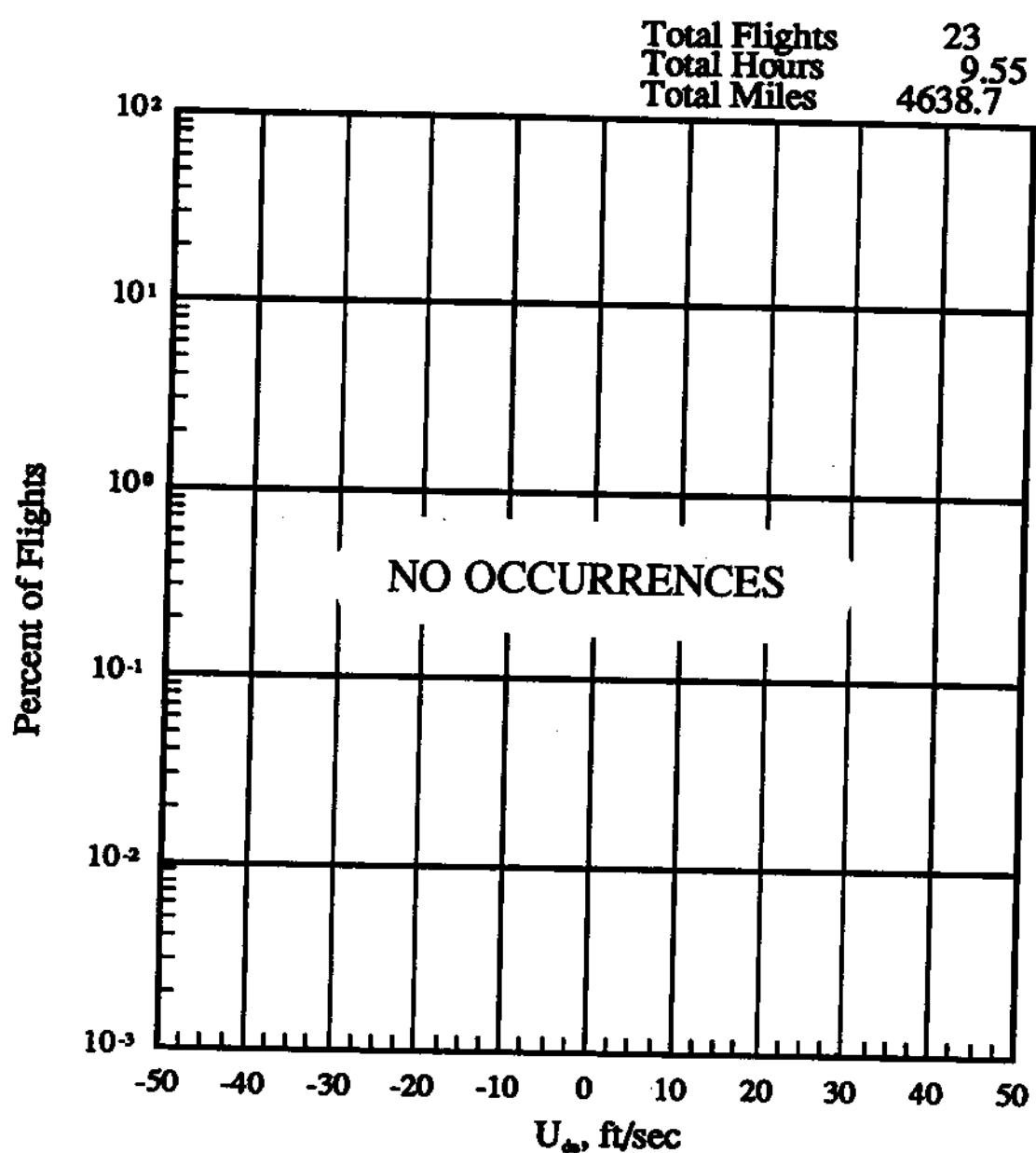
(e) 14500 to 19500 feet altitude

Figure 19.- Continued.



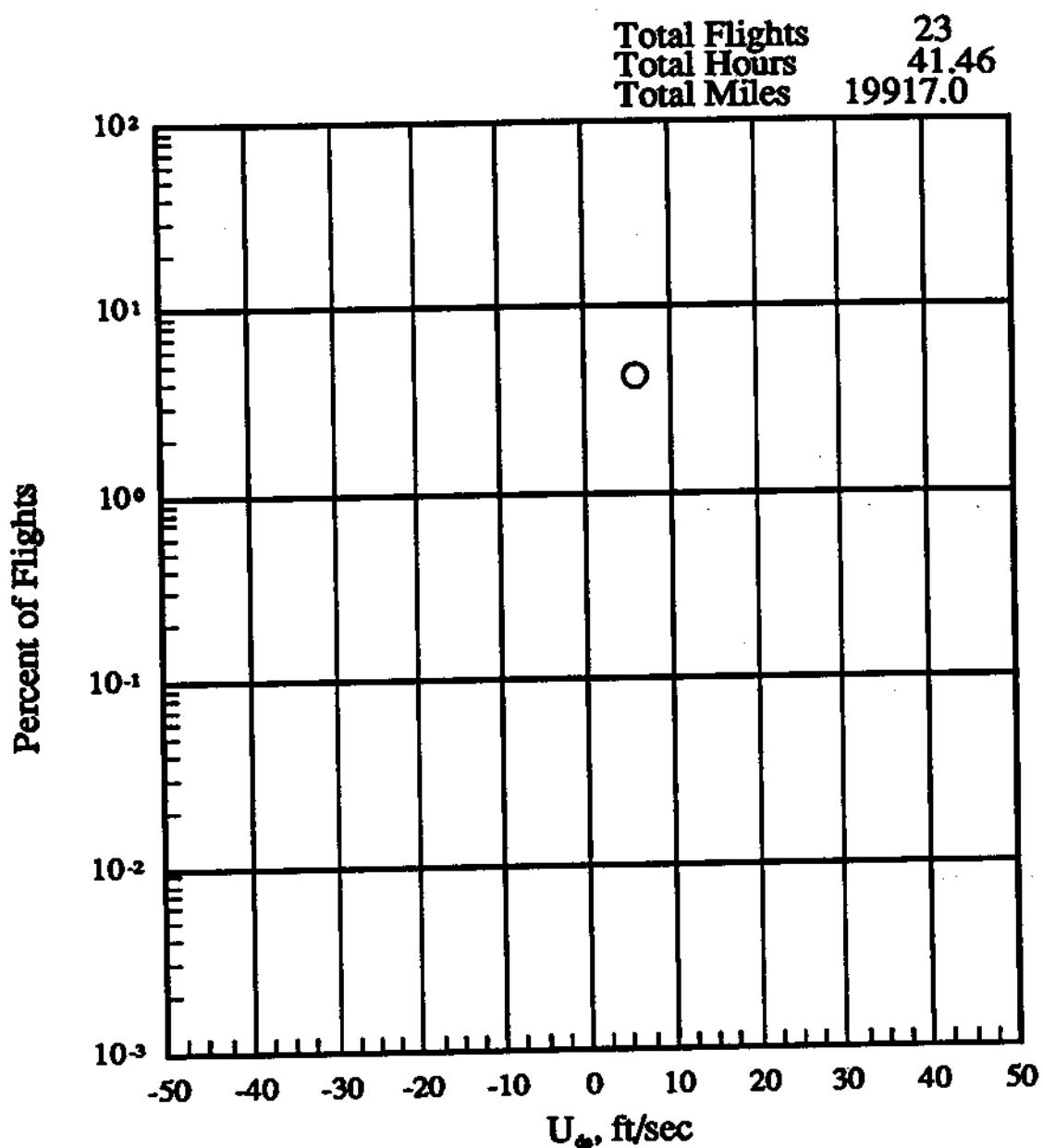
(f) 19500 to 24500 feet altitude

Figure 19.- Continued.



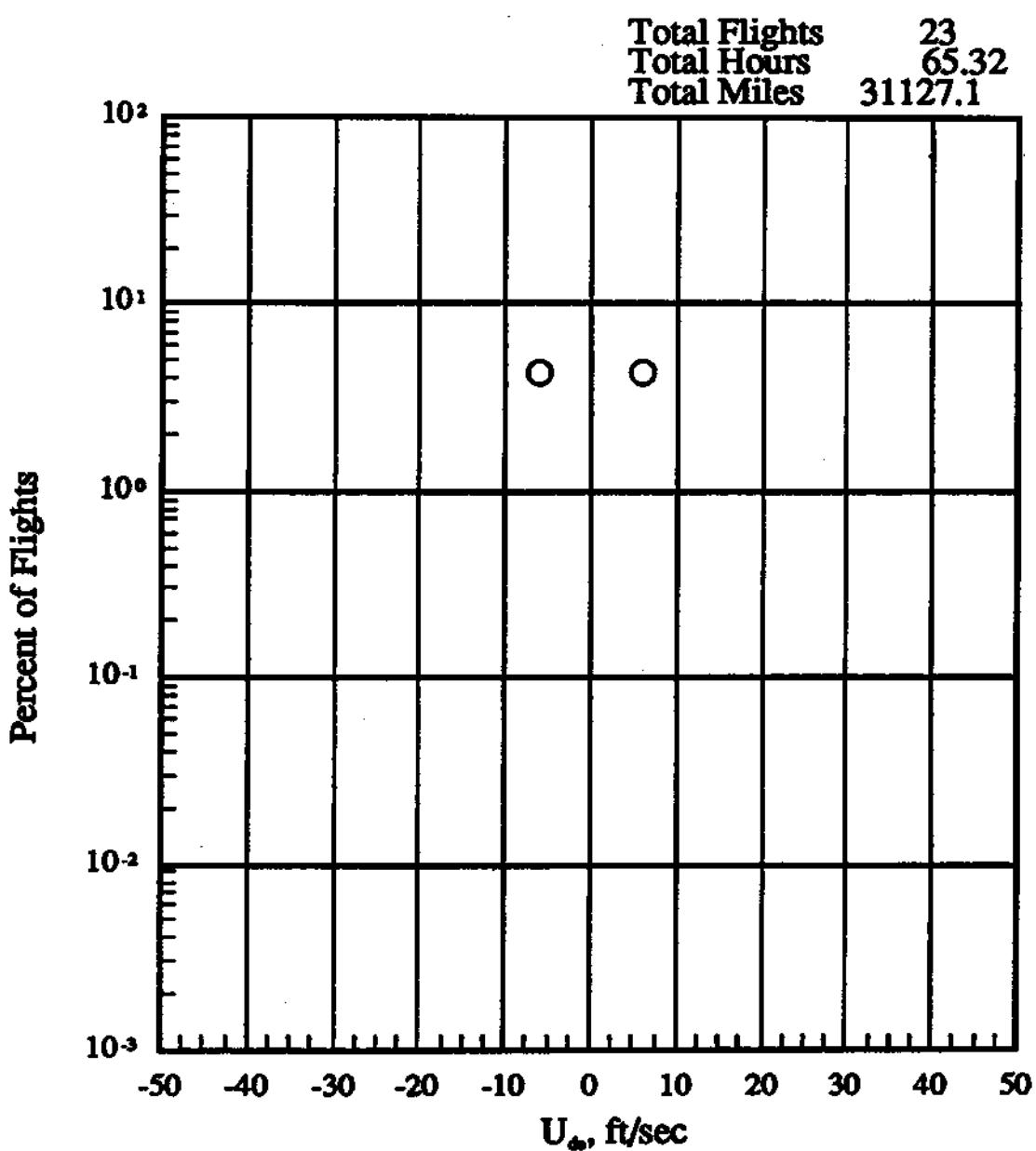
(g) 24500 to 29500 feet altitude

Figure 19.- Continued.



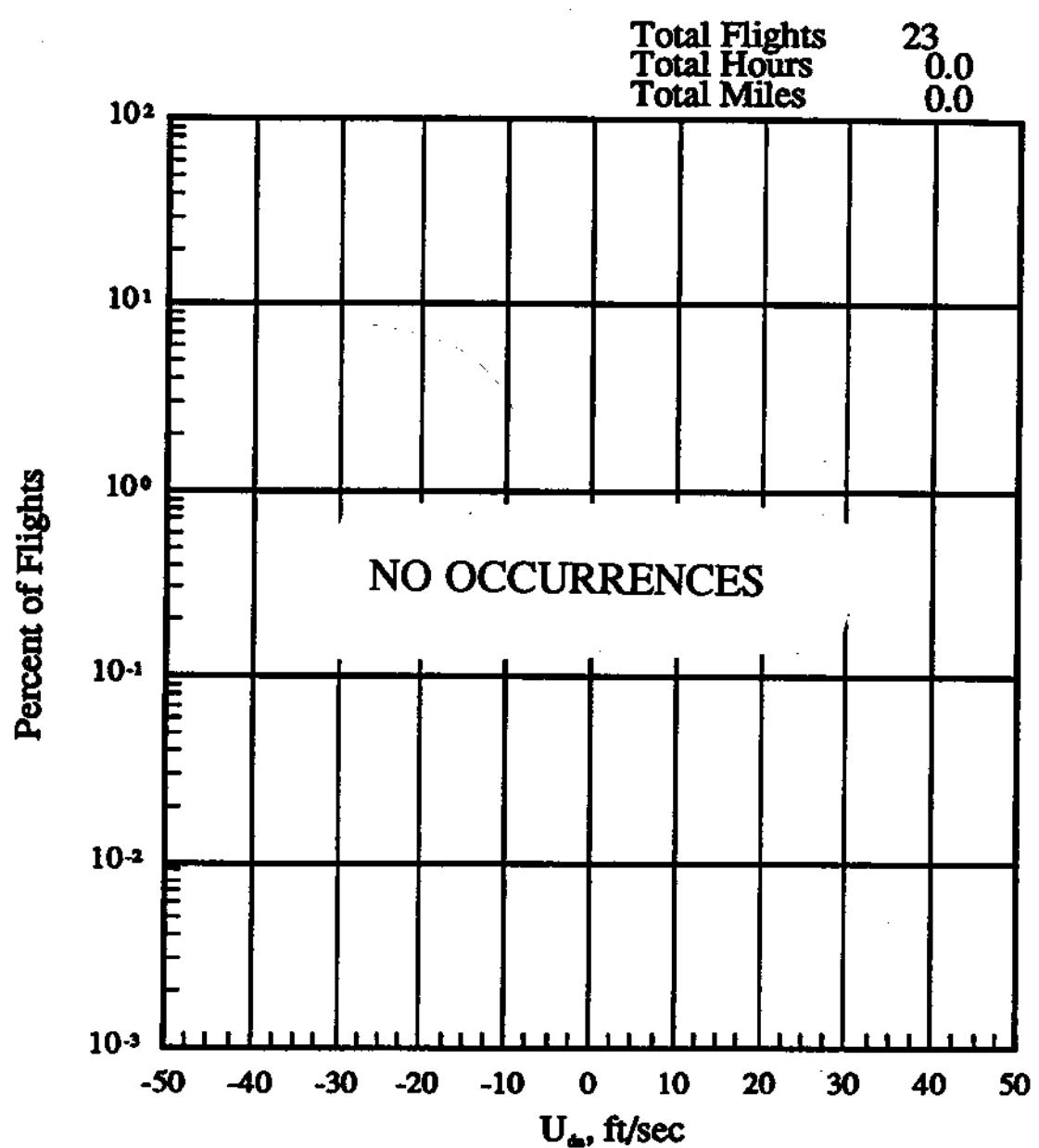
(h) 29500 to 34500 feet altitude

Figure 19.- Continued.



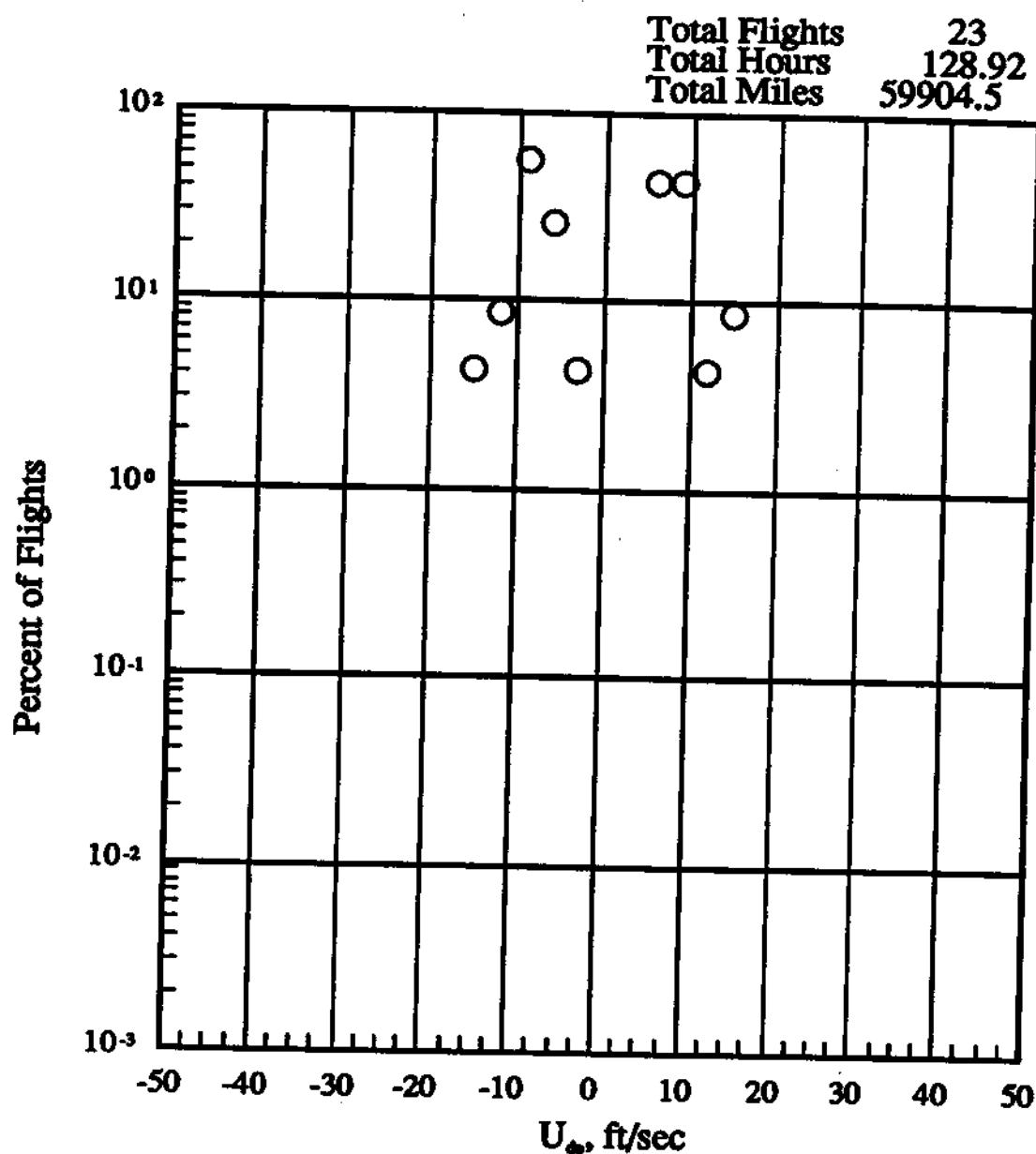
(i) 34500 to 39500 feet altitude

Figure 19.- Continued.



(j) 39500 to 44500 feet altitude

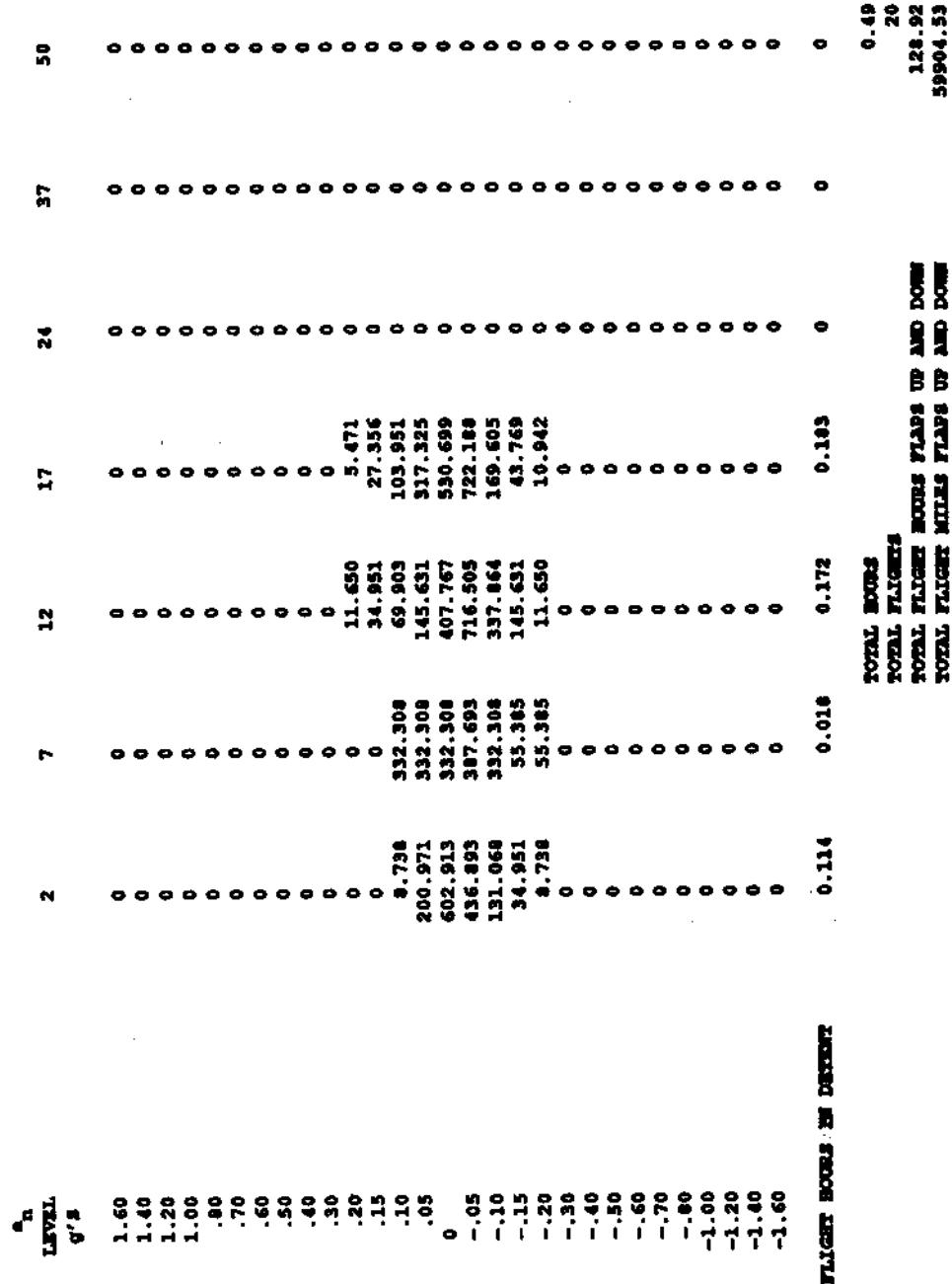
Figure 19.- Continued.



(k) -500 to 44500 feet altitude

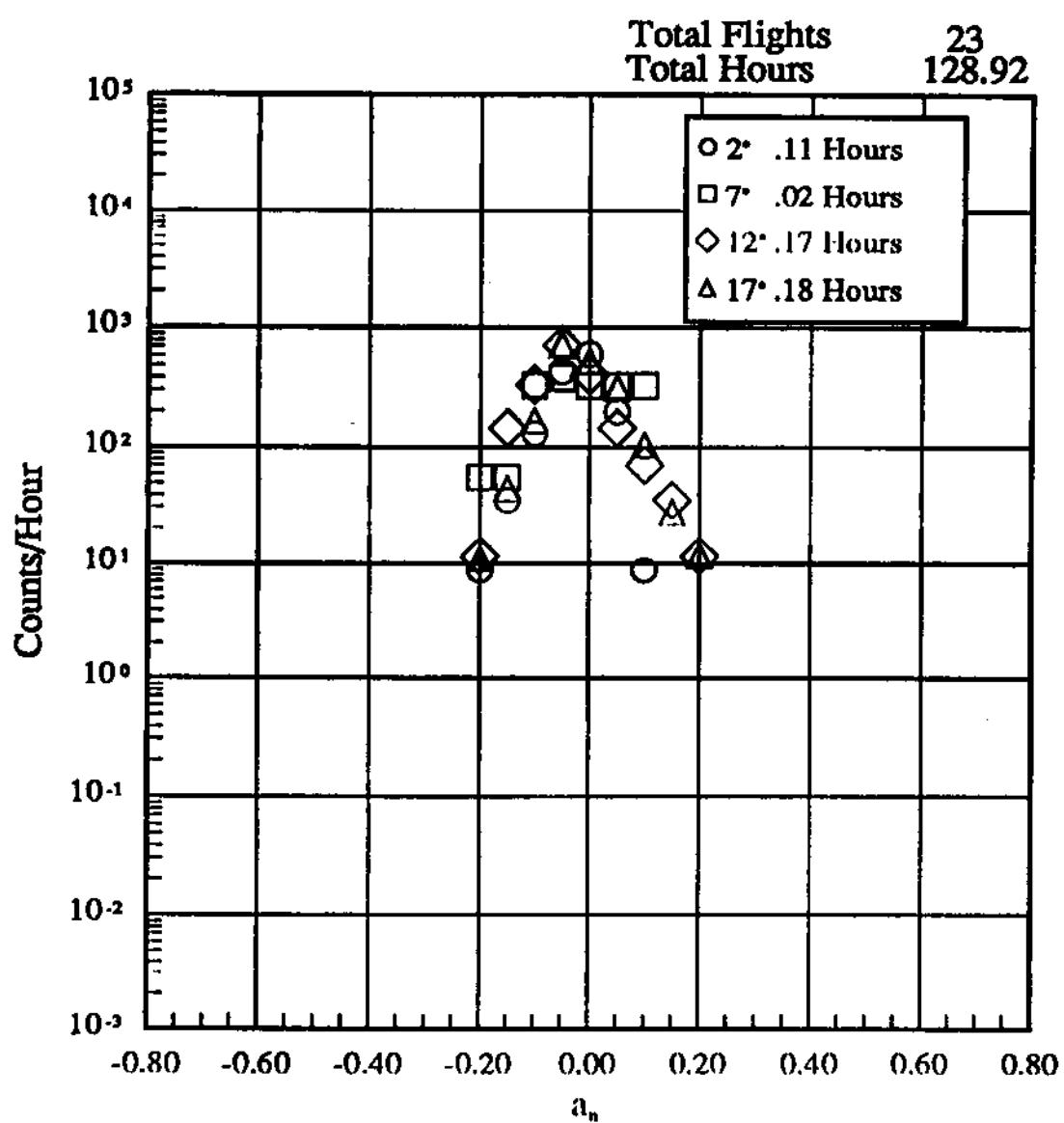
Figure 19.- Concluded.

## FLAP DETENT, DEGREES



(a) Take off

Figure 20.-  $a_h$  exceedances with flaps deflected.



(b) Take off

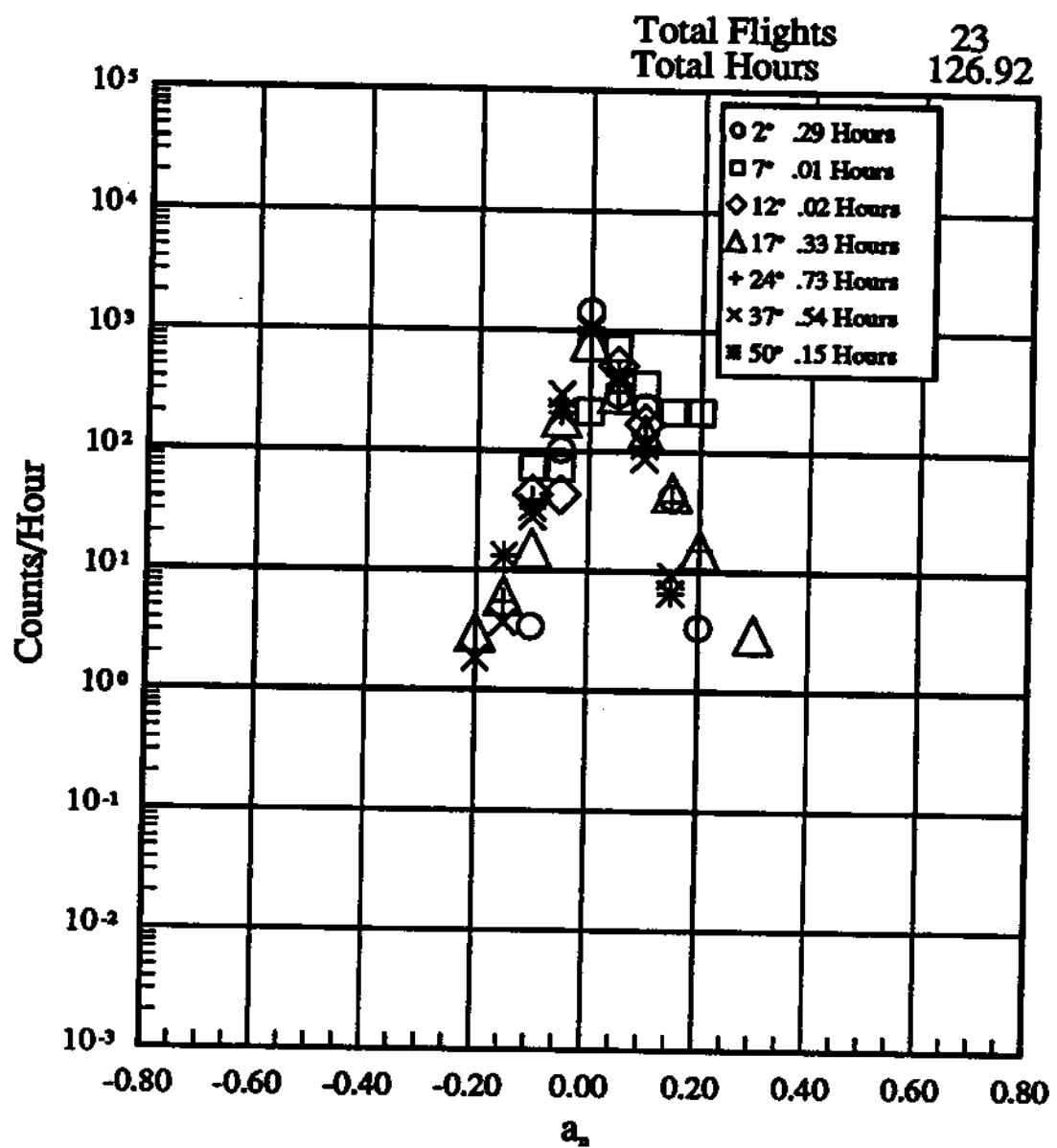
Figure 20.- Continued.

## FLAP DEFENT, DEGREES

	2	7	12	17	24	37	50
12'EL 9'S	0	0	0	0	0	0	0
1.60	0	0	0	0	0	0	0
1.40	0	0	0	0	0	0	0
1.20	0	0	0	0	0	0	0
1.00	0	0	0	0	0	0	0
.80	0	0	0	0	0	0	0
.70	0	0	0	0	0	0	0
.60	0	0	0	0	0	0	0
.50	0	0	0	0	0	0	0
.40	0	0	0	0	0	0	0
.30	0	0	0	0	3.020	0	0
.20	3.416	216.000	0	15.101	15.126	0	0
.15	40.987	216.000	0	45.302	36.503	9.257	6.602
.10	235.674	360.000	171.429	136.926	136.134	86.650	112.442
.05	297.154	720.000	514.286	305.034	314.897	386.938	435.763
0	1455.028	216.000	300.000	821.477	925.439	1007.148	1069.601
-0.05	1022.467	72.000	42.857	190.268	211.765	296.220	211.279
-0.10	3.416	72.000	42.857	15.101	38.503	27.771	33.012
-0.15	0	0	0	6.040	5.500	3.703	13.205
-0.20	0	0	0	3.020	0	1.851	0
-0.30	0	0	0	0	0	0	0
-0.40	0	0	0	0	0	0	0
-0.50	0	0	0	0	0	0	0
-0.60	0	0	0	0	0	0	0
-0.70	0	0	0	0	0	0	0
-0.80	0	0	0	0	0	0	0
-0.90	0	0	0	0	0	0	0
-1.00	0	0	0	0	0	0	0
-1.20	0	0	0	0	0	0	0
-1.40	0	0	0	0	0	0	0
-1.60	0	0	0	0	0	0	0
FLIGHT SCORES IN DEFENT	0.293	0.014	0.023	0.331	0.727	0.540	0.151
TOTAL SCORES						2.08	
TOTAL FLIGHTS						23	
TOTAL FLIGHT SCORES FLAPS UP AND DOWN						126.92	
TOTAL FLIGHT MILES FLAPS UP AND DOWN						59904.53	

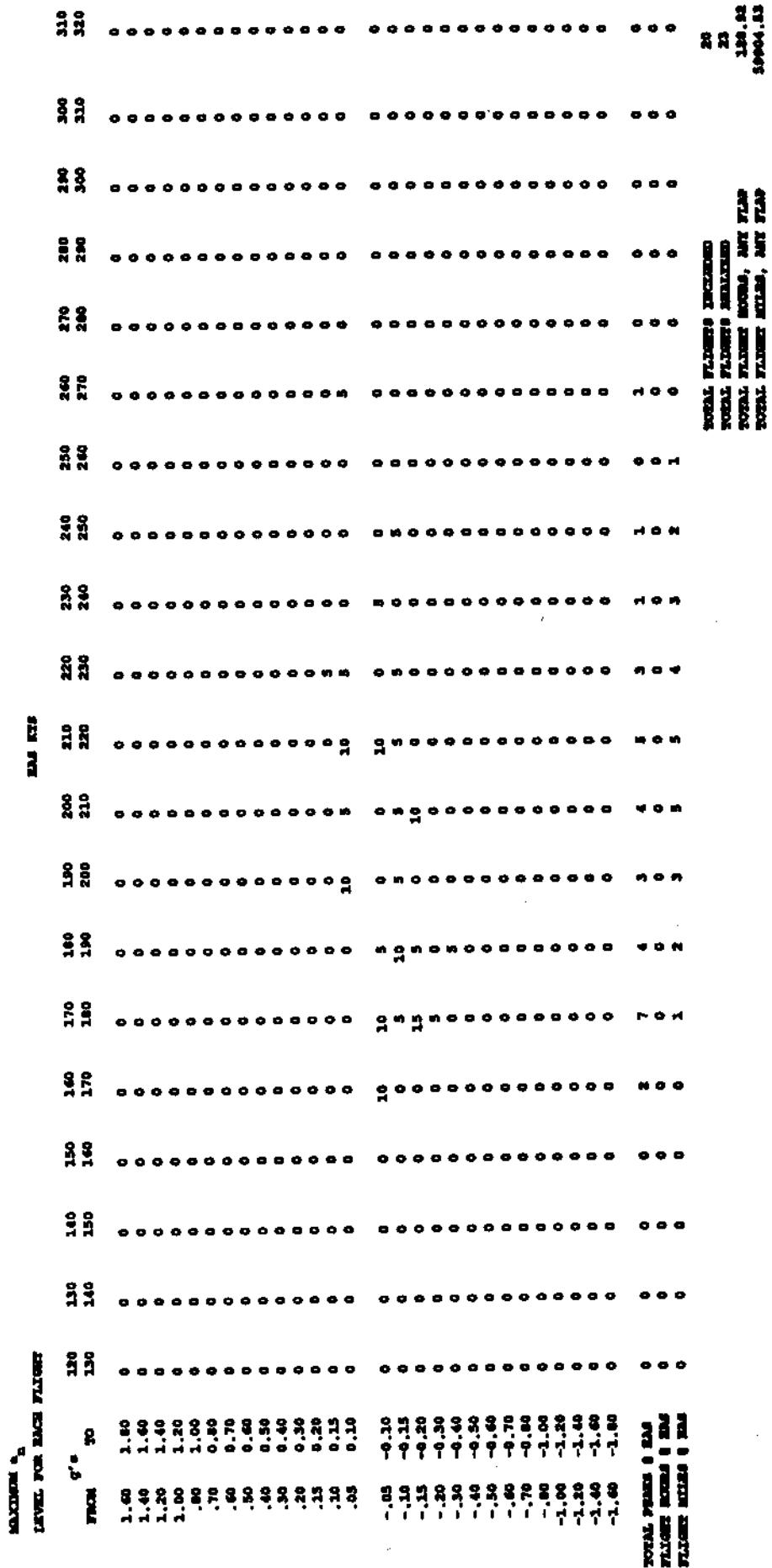
(c) Landing

Figure 20.- Continued.



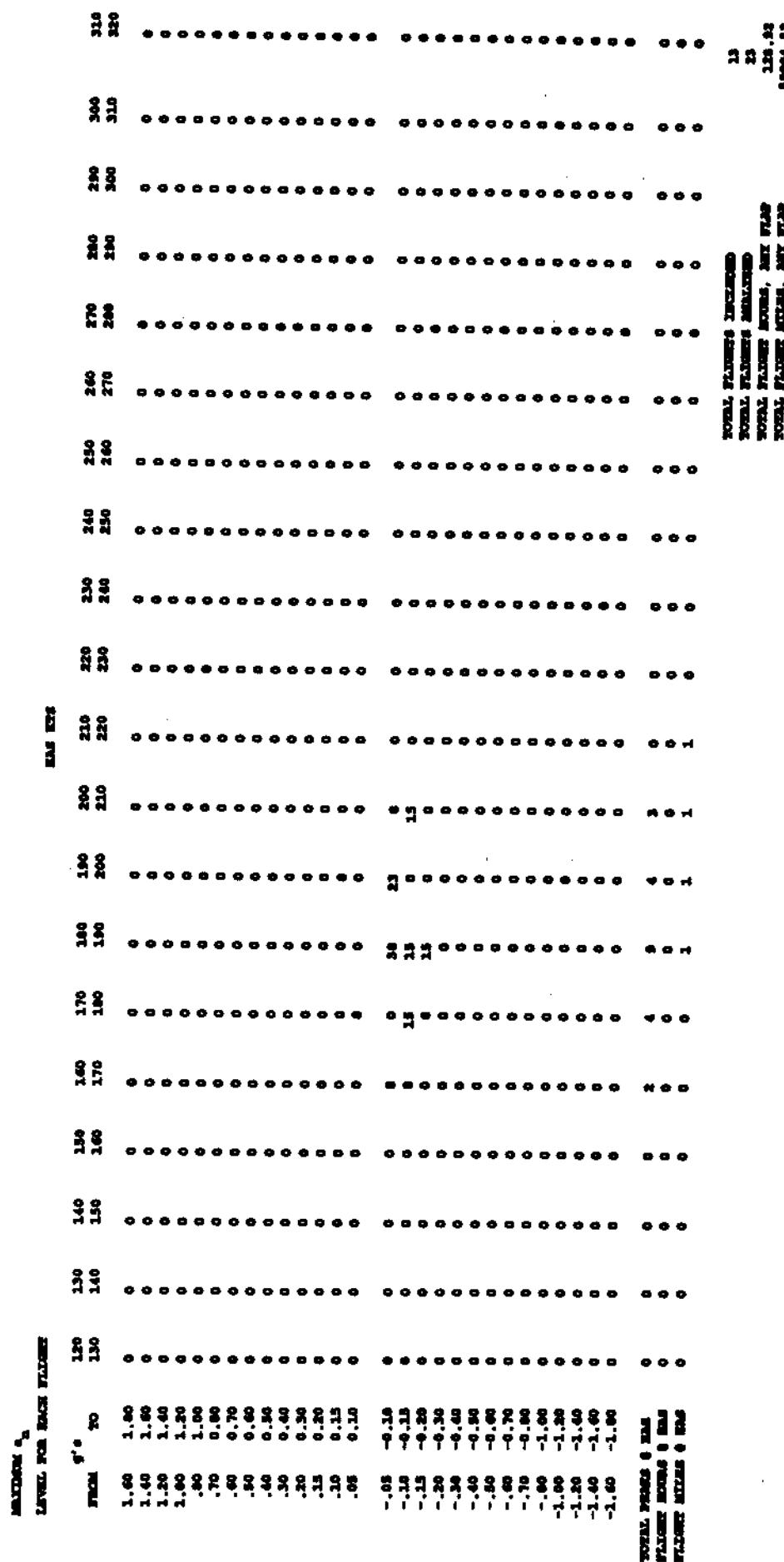
(d) Landing.

Figure 20.- Concluded.



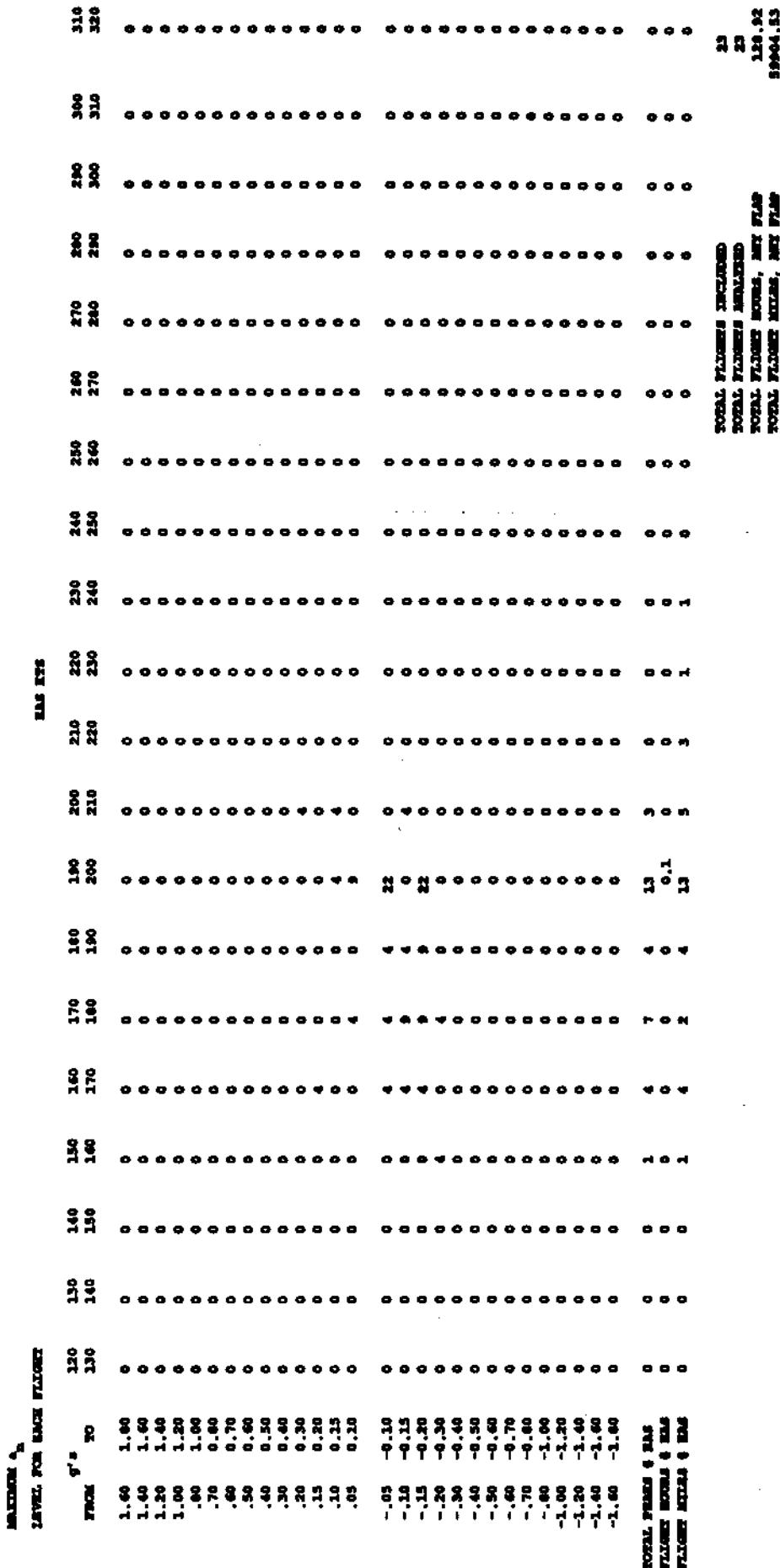
(a) Take off; flaps 2 degree detent

Figure 21.- Peak positive and negative  $\alpha_t$  per flight vs EAS bands; percent of flights.



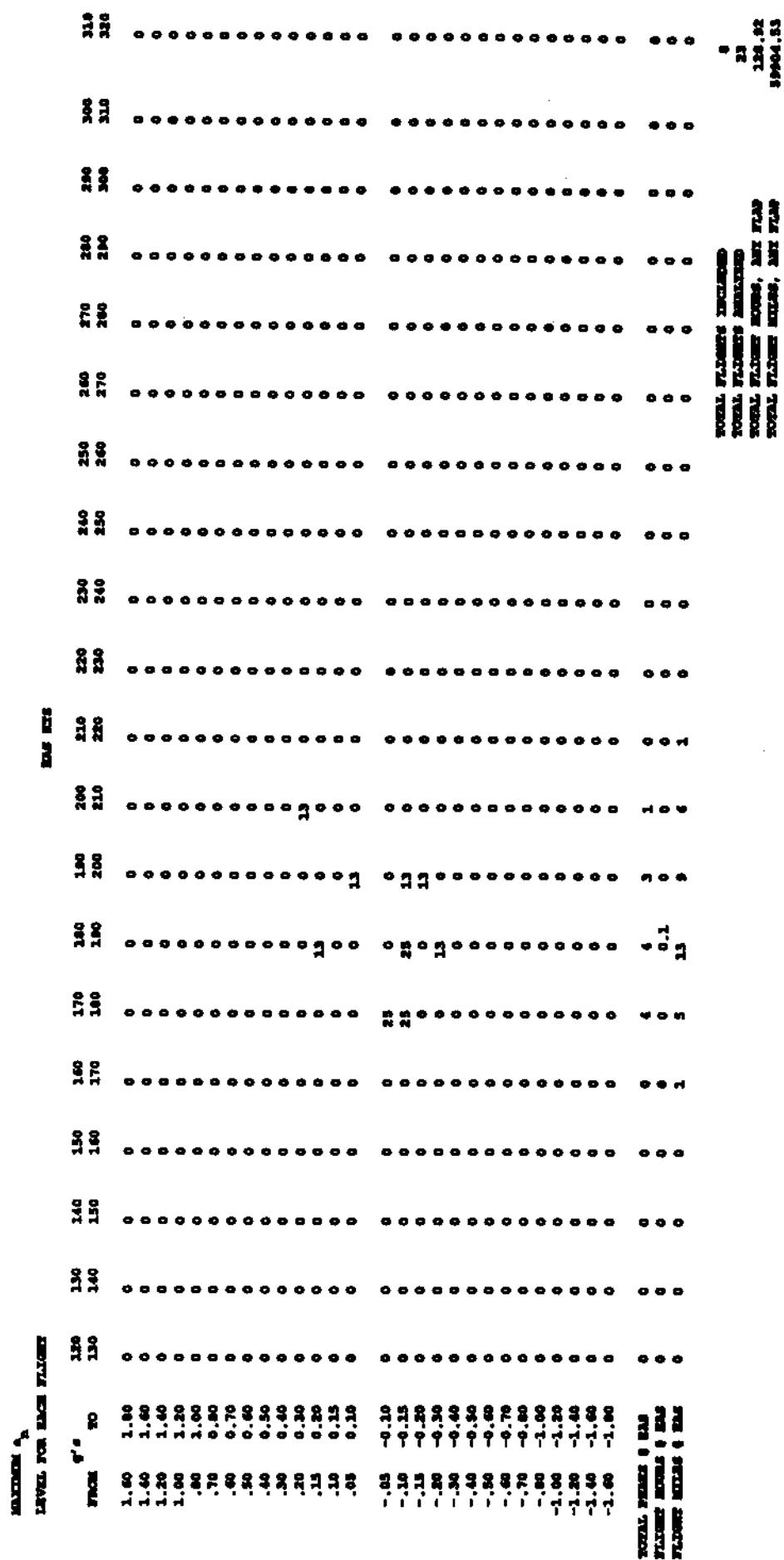
**Figure 21.-** Continued.

(b) Take off, flaps 7 degree detent



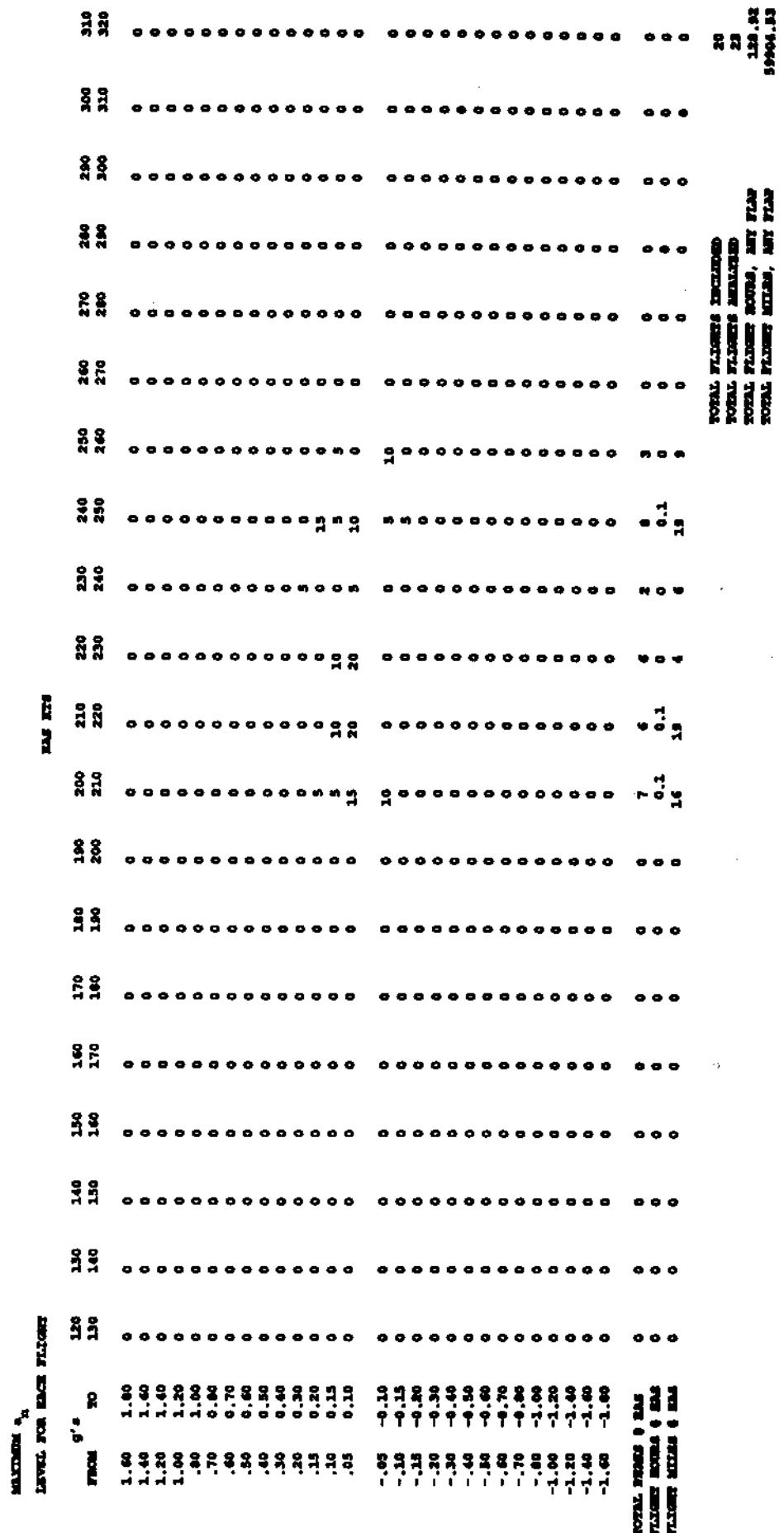
(c) Take off; flaps 12 degree detent

Figure 21.- Continued.



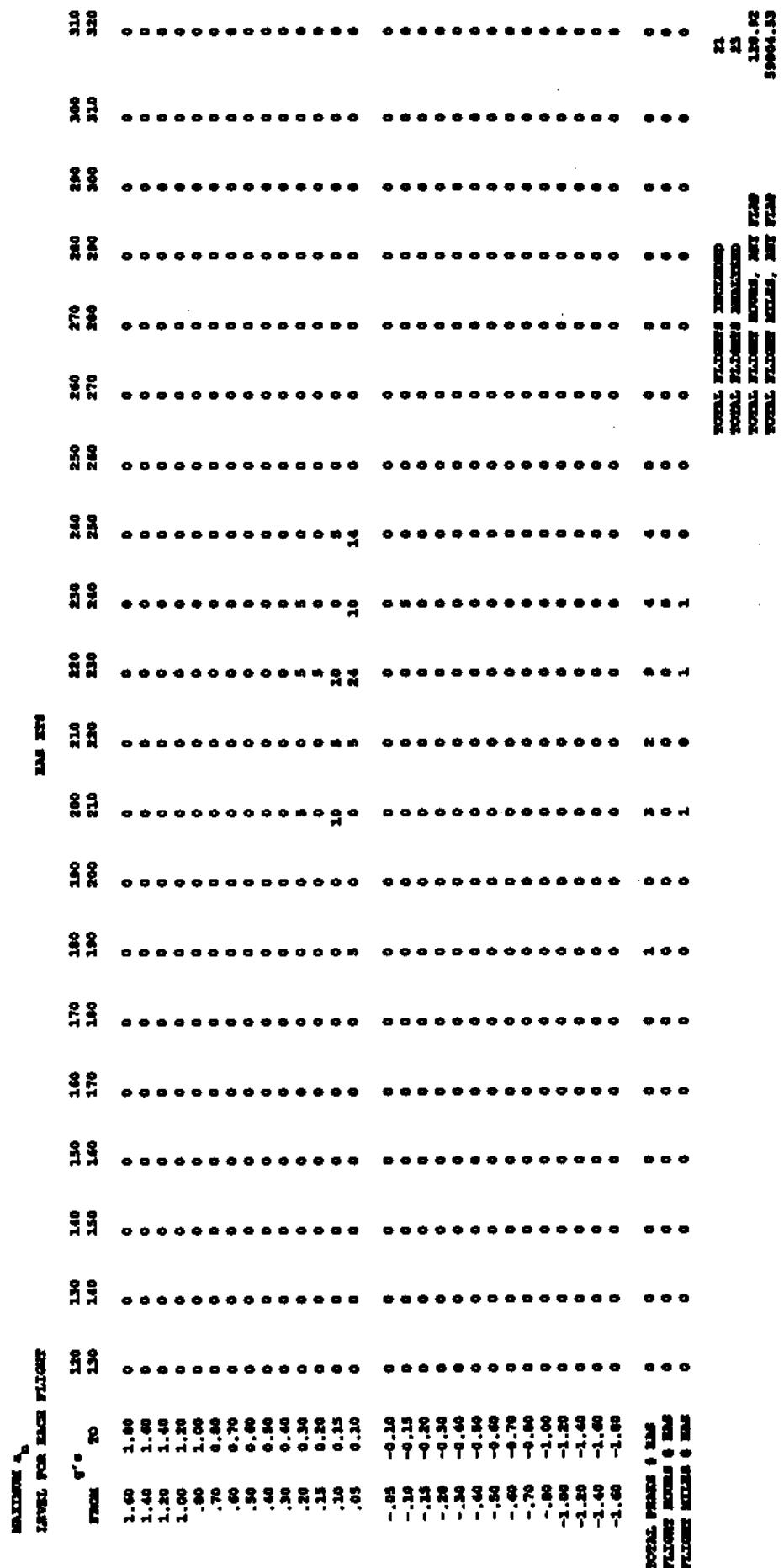
(d) Take off; flaps 17 degree defent

Figure 21.- Continued.



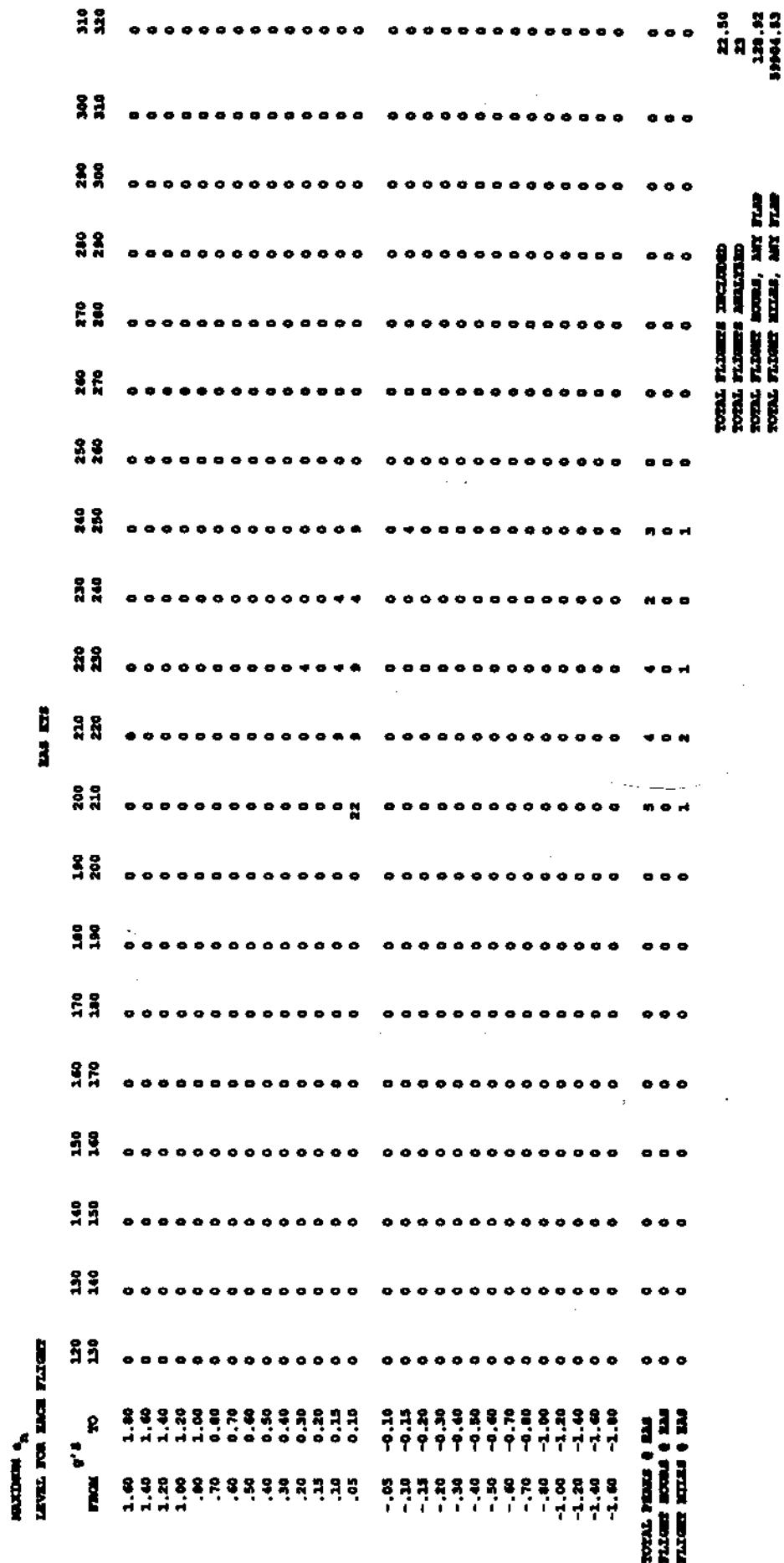
(e) Landing; flaps 2 degree detent

Figure 21.- Continued.



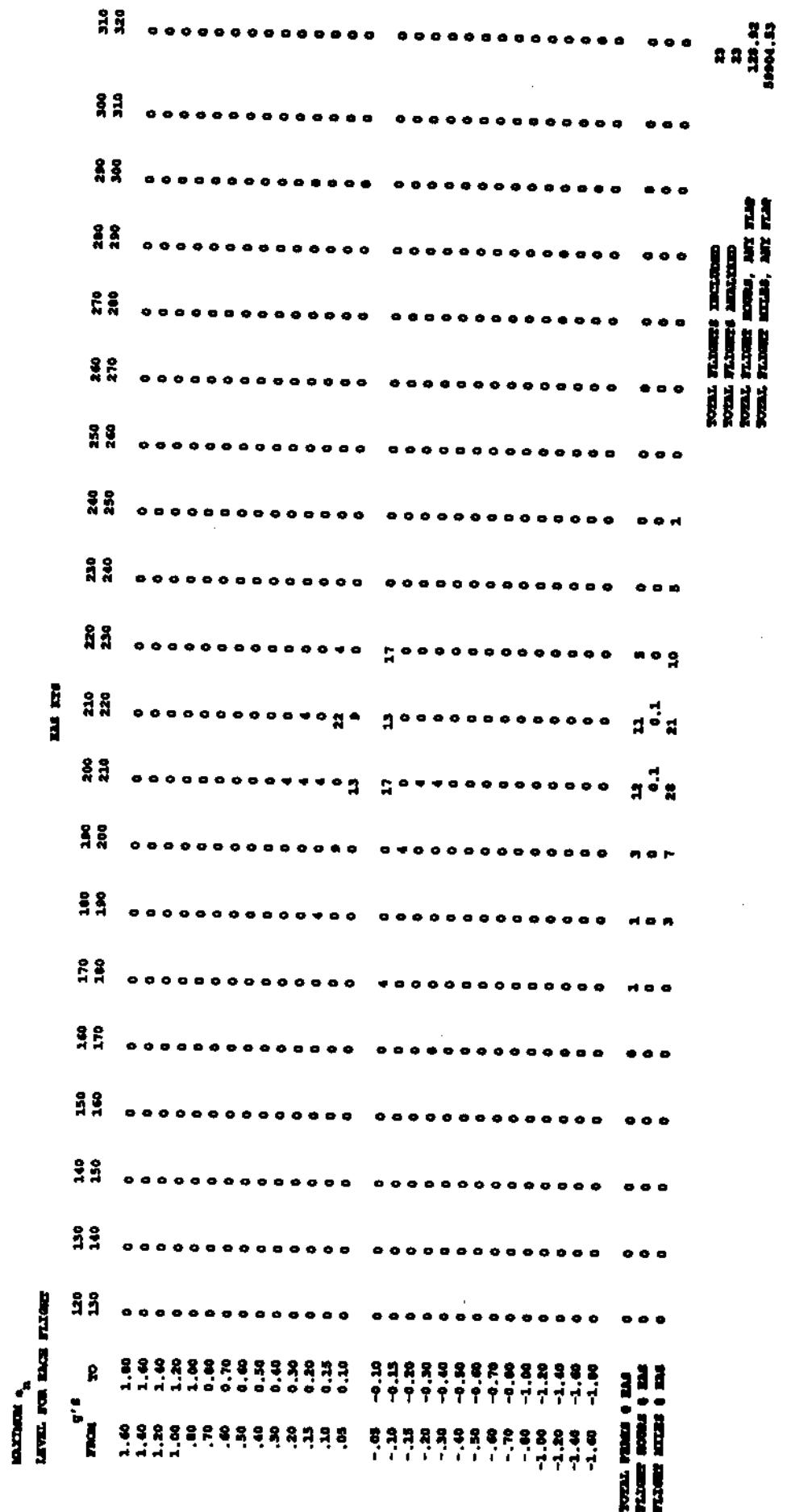
(f) Landing; flaps 7 degree detent

Figure 21.- Continued.



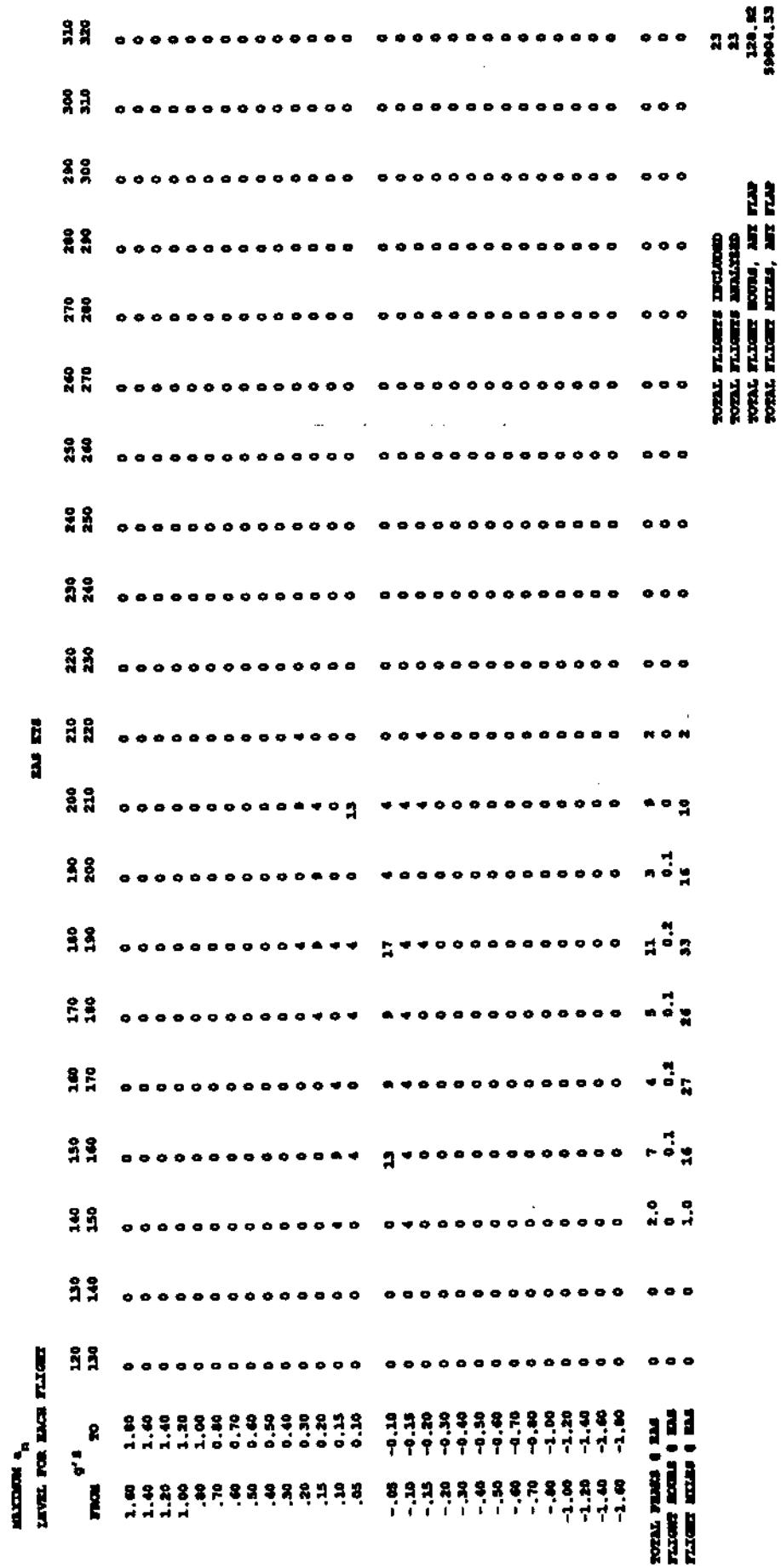
(g) Landing; flaps 12 degree detent

Figure 21.- Continued.



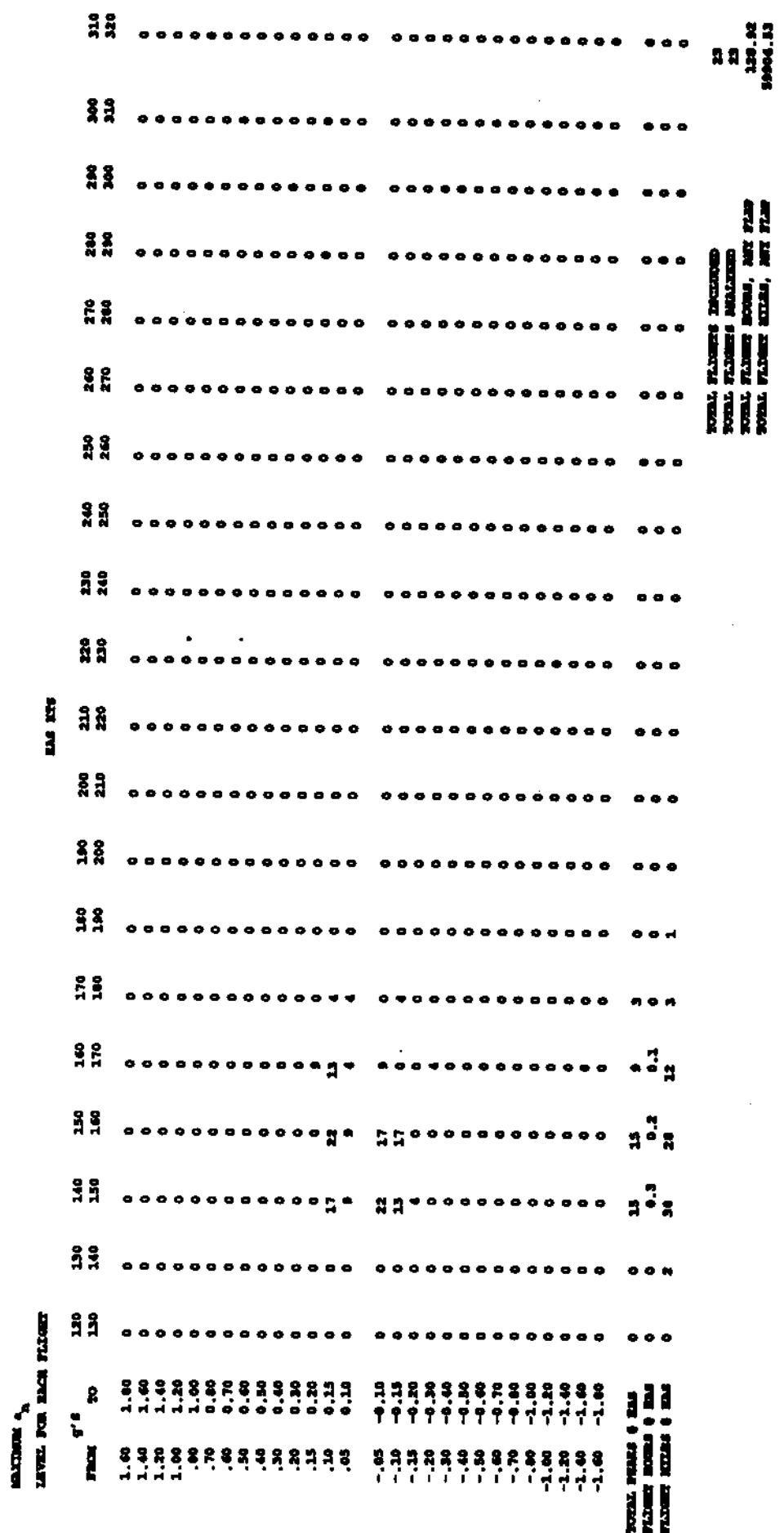
(h) Landing; flaps 17 degree defent

Figure 21.- Continued.



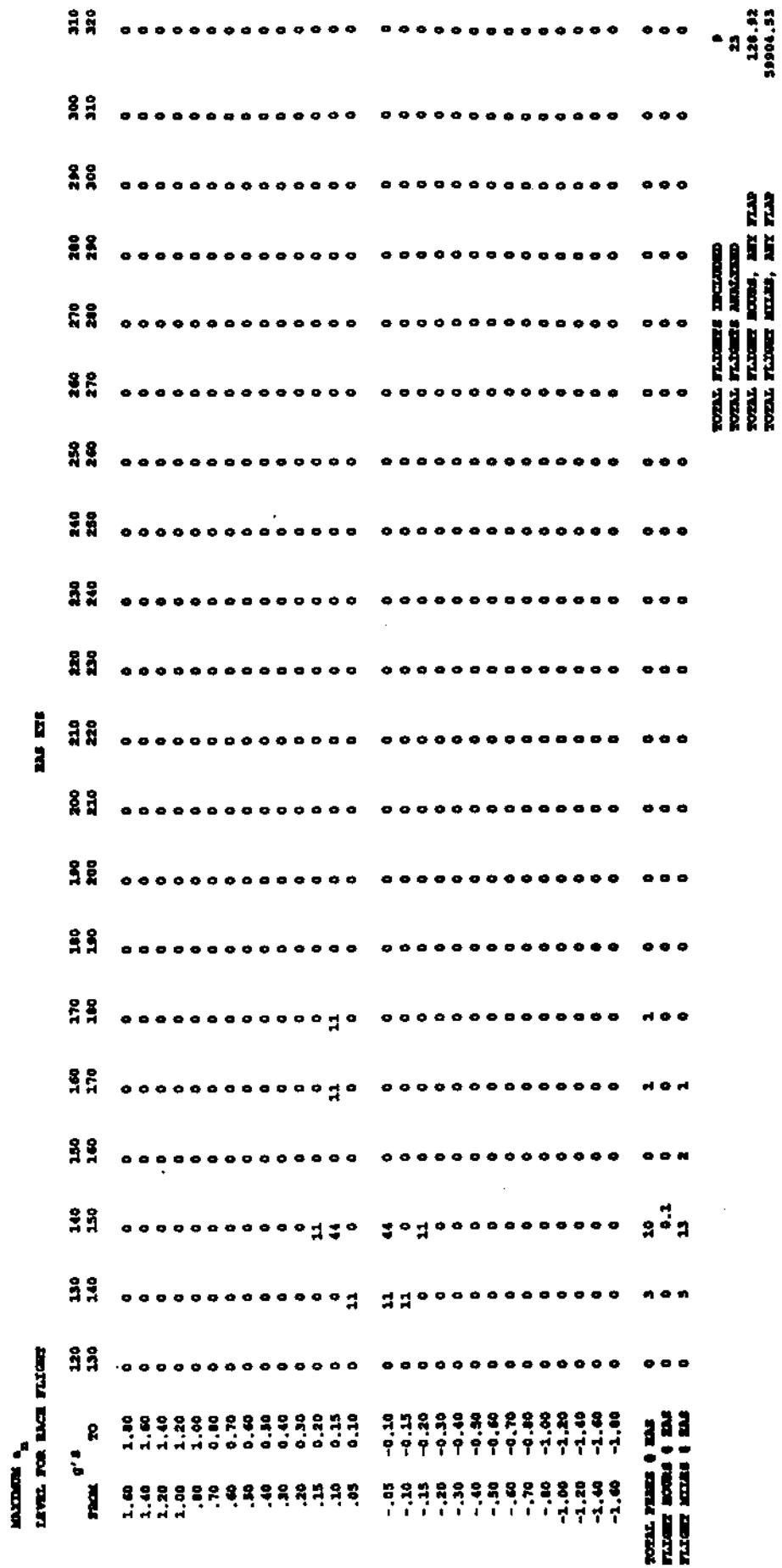
(i) Landing; flaps 24 degree detent

Figure 21.- Continued.



(j) Landing; flaps 37 degree detent

Figure 21.- Continued.



(k) Landing; flaps 50 degree detent

Figure 21.- Concluded.



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